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THE ELEMENTS OF THE EARTH'S MAGNETISM

AND

THEIR SECULAR CHANGES BETWEEN 1550 AND 1915

Dr. H. Fritsche

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saecularen Aenderungen wahrend des Zeitraumes 1550 bis 1915",  
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16. Abstract  This article contains the result of an investigation about the magnetic agents outside of the Earth's surface as well as the Earth's magnetic elements for the epochs 1550, 1900, 1915. Finally, it contains the secular changes of the Earth's matnetic elements during the time interval 1550 - 1900.			
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THE ELEMENTS OF THE EARTH'S MAGNETISM  
and  
Their Secular Changes between 1550 and 1915  
PUBLICATION III

Dr. H. Fritsche<sup>#</sup>

CHAPTER 1

a. Influence of magnetically acting agents which could be located on the Earth's surface.

/1\*

I have published two papers with the following titles about determining the elements of the Earth's magnetism using the Gauss theory and observations:

I. Determination of the coefficients of the Gauss general theory of the Earth's magnetism for the year 1885 and about the relationship of the three Earth-magnetic elements, St. Petersburg, 1897.\*\*

II. The elements of the Earth's magnetism for the epochs 1600, 1650, 1700, 1780, 1842 and 1885 and their secular changes, calculated with the coefficients of the Gauss "General Theory of the Earth's Magnetism", St. Petersburg, 1899, which was derived from all of the usable observations.\*\*\*

In the following I will call the first of these papers "Publication I" and the second will be called "Publication II". The present paper, my third publication, about this topic is an addition: It contains the result of an investigation about the magnetic agents

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\* Numbers in the margin indicate pagination of foreign text.

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outside of the Earth's surface as well as the Earth's magnetic elements for the epochs 1550, 1900, 1915. Finally, it contains the secular changes of the Earth's magnetic elements during the time interval 1550-1900.

Some scientists have spread the false belief that Gauss when setting up a general theory of the Earth's magnetism only considered the inner magnetic Earth's forces, which are located inside the Earth and that he ignored the effects of the agents acting outside of the Earth's surface (for example, in the atmosphere). For example, L. A. Bauer in the Terrestrial Magnetism Magazine of March 1899 on page 34 (he is the editor) "he (Gauss) supposed the entire magnetism was due to causes within the Earth's crust".

A. Schmidt also has the same opinion, for example, in the magazine "Terrestrial Magnetism" volume II, (December ), 1897, page 150. Also D. W. Littlehales in the "Terrestrial Magnetism", March 1900 page 39" in his paper about a not-yet completed book "An Account of the Late Professor Adams' Determination of the Gaussian Magnetic Constants". The equation formulated by Adams not only includes the magnetic constants of the class that were determined by Gauss as due to forces residing inside of the Earth, but they also take into account those forces which depend on sources outside of the Earth. /2  
The number of magnetic constants contained in them is 120 for the class resulting from exterior influences and 120 for the class resulting from interior influences, or 240 magnetic constants in all, in place of the 24 constants of the interior class that were previously determined by Gauss.

I congratulate on the determination of 240 constants (coefficients GH) of the theory, both from the now available material and the material to be available in the future! In this way, the theory would be reduced to simple interpolation. I have proven\* that 46 coefficients GH of the theory are sufficient for representing the

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\*\* cf. publication I page 27.

observations completely because they cause the magnetic anomalies which can be found everywhere on the Earth. This means a larger number of coefficients than 46 would not bring about any noticeable reduction in the distances between the theory and the observation. As we will see later on, all of the observations of the 19th Century are not sufficient for an exact calculation of only 46 coefficients of the theory for the inner and 46 coefficients for the outer forces.

In the journal "Terrestrial Magnetism", September 1889 page 211, the editor Bauer gave an angry reply to my already published papers about the use of the Gauss theory because I demonstrated that his discovery about the secular variation was erroneous and that I criticized his so-called friends. I am convinced that my difficult work will be applauded by the specialists. The opinion of a talkative young person such as Bauer does not mean anything to me because for four decades I have worked on the exact scientific contributions (my first astronomical paper about the planet 65 appeared in no. 1420 of the Astronomical News, June 3, 1863).

One can easily demonstrate that Gauss gave the required rules for determining the magnetic forces not just inside but outside of the Earth's surface as can be demonstrated from paragraphs 36-41 on pages 169-175 of his theory. I use these rules to calculate the coefficients GH of the theory for the inner and outer magnetic forces. First, I determined GH only from the (observed) components X and Y. Then I determined GH separately only from the (observed) vertical component Z. From the combination of both series of the GH, I calculated the values of the GH both for the inner and outer forces according to the rules given in Chapter 40. The flattening of the Earth was also considered, but it only has a small influence. I used the same combinations of the primitive equations which are used in Publication I page 13 and the following. Here I will give the final equation for the two epochs 1842 and 1885 because the earlier epochs 1780, 1700, etc., should not be considered because of the deficient observations.

Formula (1)

<p>Epoch 1885.1842</p> <p>gh only determined from X</p> $  \begin{aligned}  &+11.471g^{10} + 4.500g^{10} + 1.394g^{10} - 35.627 - 36.397 = 0 \\  &-0.556g^{10} + 6.820g^{10} + 1.834g^{10} + 3.044 + 3.096 = 0 \\  &-0.241g^{10} + 1.978g^{10} + 3.128g^{10} + 0.812 + 0.842 = 0  \end{aligned}  $		<p>Epoch 1885.1842</p> <p>gh only determined from X</p> $  \begin{aligned}  &+14.364g^{10} + 4.664g^{10} + 0.970g^{10} - 40.63 + 0.569 = 0 \\  &-0.409g^{10} + 5.280g^{10} + 0.764g^{10} + 2.245 + 1.731 = 0 \\  &0g^{10} - 0.007g^{10} + 1.350g^{10} + 0.244 + 0.157 = 0  \end{aligned}  $	
<p>Epoch 1885.1842</p> <p>gh only determined from Z</p> $  \begin{aligned}  &+20.860g^{10} + 1.528g^{10} + 1.238g^{10} - 65.255 - 66.562 = 0 \\  &+1.464g^{10} + 10.636g^{10} + 1.226g^{10} - 1.857 - 2.410 = 0 \\  &+0.660g^{10} + 2.328g^{10} + 3.902g^{10} - 1.665 - 1.290 = 0  \end{aligned}  $		<p>Epoch 1885.1842</p> <p>gh only determined from Z</p> $  \begin{aligned}  &+16.238g^{10} + 1.016g^{10} - 0.103g^{10} - 0.214 + 0.310 = 0 \\  &+2.796g^{10} + 6.436g^{10} + 0.423g^{10} + 2.623 + 1.879 = 0 \\  &-0.180g^{10} + 1.350g^{10} + 2.000g^{10} + 0.810 + 0.363 = 0  \end{aligned}  $	
<p>Epoch 1885</p> <p>gh only determined from X,Y</p> $  \begin{aligned}  &+22.384g^{11} + 0.644g^{11} - 0.750g^{11} - 5.476 + 13.411 \\  &-0.312g^{11} + 12.308g^{11} + 1.198g^{11} - 3.707 - 1.628 \\  &-0.548g^{11} - 0.246g^{11} + 3.984g^{11} + 1.642 - 1.758  \end{aligned}  $		<p>Epoch 1842</p> <p>gh only determined from X,Y</p> $  \begin{aligned}  &-6.691 + 13.644 = 0 \\  &-3.342 - 1.838 = 0 \\  &+1.975 - 1.256 = 0  \end{aligned}  $	
<p>Epoch 1885</p> <p>gh only determined from X,Y</p> $  \begin{aligned}  &+12.927g^{11} + 1.341g^{11} - 0.646g^{11} + 2.612 - 2.389 \\  &+0.260g^{11} + 6.722g^{11} + 0.716g^{11} + 2.174 + 0.834 \\  &+0.063g^{11} + 0.937g^{11} + 2.390g^{11} + 0.674 + 0.670  \end{aligned}  $		<p>Epoch 1842</p> <p>gh only determined from X,Y</p> $  \begin{aligned}  &+2.364 - 0.391 = 0 \\  &+2.221 + 0.488 = 0 \\  &+0.643 + 0.326 = 0  \end{aligned}  $	
<p>Epoch 1885</p> <p>gh only determined from Z</p> $  \begin{aligned}  &+20.798g^{11} + 3.010g^{11} - 0.012g^{11} - 6.476 + 12.107 \\  &0g^{11} + 11.196g^{11} + 1.400g^{11} - 4.556 - 1.939 \\  &-0.284g^{11} + 1.972g^{11} + 3.274g^{11} + 0.030 - 2.121  \end{aligned}  $		<p>Epoch 1842</p> <p>gh only determined from Z</p> $  \begin{aligned}  &-6.729 + 11.680 = 0 \\  &-3.517 - 1.891 = 0 \\  &+0.658 - 1.368 = 0  \end{aligned}  $	
<p>Epoch 1885</p> <p>gh only determined from Z</p> $  \begin{aligned}  &+14.058g^{11} - 0.360g^{11} + 0.052g^{11} + 6.986 - 1.900 \\  &0g^{11} + 7.090g^{11} + 0.898g^{11} + 2.529 + 1.324 \\  &0g^{11} + 2.276g^{11} + 0.525 + 0.381  \end{aligned}  $		<p>Epoch 1842</p> <p>gh only determined from Z</p> $  \begin{aligned}  &+6.586 - 0.387 = 0 \\  &+2.833 + 0.315 = 0 \\  &+0.310 - 0.075 = 0  \end{aligned}  $	
<p>Epoch 1885</p> <p>gh only determined from X,Y</p> $  \begin{aligned}  &+22.856g^{12} + 1.040g^{12} - 0.083g^{12} + 1.783 + 3.374 \\  &-0.742g^{12} + 10.700g^{12} + 0.571g^{12} + 2.328 - 0.612 \\  &-0.288g^{12} + 0.950g^{12} + 3.479g^{12} + 0.117 + 0.120  \end{aligned}  $		<p>Epoch 1842</p> <p>gh only determined from X,Y</p> $  \begin{aligned}  &+0.416 + 3.079 = 0 \\  &+1.845 - 1.021 = 0 \\  &-0.144 - 0.028 = 0  \end{aligned}  $	
<p>Epoch 1885</p> <p>gh only determined from X,Y</p> $  \begin{aligned}  &+16.485g^{12} - 0.067g^{12} + 4.179 + 0.156 \\  &+0.531g^{12} + 0.449g^{12} + 1.596 + 0.043  \end{aligned}  $		<p>Epoch 1842</p> <p>gh only determined from X,Y</p> $  \begin{aligned}  &+4.126 + 0.618 = 0 \\  &+2.011 + 0.036 = 0  \end{aligned}  $	
<p>Epoch 1885</p> <p>gh only determined from Z</p> $  \begin{aligned}  &+22.136g^{12} + 0.354g^{12} - 0.490g^{12} + 1.552 + 2.743 \\  &+0.286g^{12} + 7.064g^{12} + 0.344g^{12} + 1.410 - 0.419 \\  &+0.182g^{12} + 0.248g^{12} + 2.810g^{12} - 0.226 + 0.496  \end{aligned}  $		<p>Epoch 1842</p> <p>gh only determined from Z</p> $  \begin{aligned}  &+0.218 + 2.620 = 0 \\  &+0.981 - 0.623 = 0 \\  &-0.343 + 0.085 = 0  \end{aligned}  $	

gh only determined from Z

$$+14,046g^{1,2} + 0,638g^{2,2} + 4,086 - 0,131 + 4,165 + 0,621 = 0$$

$$-1,620g^{1,2} + 4,428g^{2,2} + 0,227 - 0,383 + 0,939 + 0,244 = 0$$


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gh only determined from X, Y

$$+17,000g^{1,1} + 0,275g^{2,1} - 1,016 - 0,718 - 0,663 - 0,697 = 0$$

$$+ 0,297g^{1,2} + 4,565g^{2,2} + 0,587 - 0,342 - 0,728 - 0,162 = 0$$

$$+ 3,989g^{1,1} + 0,146g^{2,1} + 1,086 + 1,581 + 0,528 + 0,192 = 0$$

$$- 2,316g^{1,2} + 0,589g^{2,2} + 0,210 - 0,132 + 0,079 - 0,137 = 0$$


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gh only determined from Z

$$+26,268g^{1,1} + 0,389g^{2,1} - 1,016 - 0,718 - 0,663 - 0,697 = 0$$

$$+ 0,596g^{1,2} + 7,199g^{2,2} + 0,328 - 0,198 - 0,048 - 0,001 = 0$$

$$- 0,082g^{1,1} + 2,908g^{2,1} + 0,549 - 0,236 - 0,333 - 0,238 = 0$$


---

gh only determined from X, Y

$$+34,800g^{1,1} + 0,348g^{2,1} + 0,321 - 0,476 + 0,052 - 0,296 = 0$$

$$+ 0,253g^{1,2} + 7,549g^{2,2} + 0,184 - 0,250 - 0,145 - 0,195 = 0$$

$$+ 15,249g^{1,1} + 0,253g^{2,1} + 0,253 - 0,222 - 0,158 - 0,207 = 0$$


---

gh only determined from Z

$$+28,800g^{1,1} + 0,260g^{2,1} + 0,080 - 0,184 - 0,061 - 0,163 = 0$$

$$- 0,679g^{1,2} + 5,188g^{2,2} - 0,069 - 0,192 - 0,038 + 0,031 = 0$$

$$+ 12,100g^{1,1} + 0,114g^{2,1} + 0,139 - 0,141 - 0,101 = 0$$


---

gh only determined from X, Y

$$+35,554g^{1,1} + 0,220g^{2,1} + 0,135 + 0,152 + 0,130 = 0$$

$$+ 17,339g^{1,2} + 0,263g^{2,2} + 0,250 + 0,090 + 0,139 = 0$$


---

gh only determined from Z

$$+30,814g^{1,1} + 0,203g^{2,1} + 0,151 + 0,351 + 0,151 = 0$$

$$+ 13,160g^{1,2} + 0,166g^{2,2} + 0,317 + 0,018 + 0,375 = 0$$

From this we obtain the following values for the coefficients gh,

Table (2). Epoch 1842.

from  $X + 3,2452 - 0,0016 - 0,2224 - 0,2936 + 0,1229 - 0,0826$

$Z + 3,2097 - 0,0007 - 0,2088 - 0,2928 - 0,0556 + 0,0161$

from  $X = Y + 0,2750 - 0,4760 + 0,3230 - 0,2975 - 0,6379 - 0,150 - 0,6047 + 0,0220 + 0,1100 - 0,0644 + 0,2389$

$Z + 0,2713 - 0,4777 + 0,3173 - 0,3824 - 0,2379 - 0,1362 - 0,5823 + 0,0262 + 0,1419 - 0,0407 + 0,2163$

from  $X = Y - 0,0928 - 0,0078 - 0,2515 - 0,1777 - 0,2511 + 0,0088 - 0,1100 - 0,0375 + 0,0091 - 0,0025 - 0,0253$

$Z + 0,0310 - 0,0045 - 0,2825 - 0,1449 - 0,3077 + 0,1552 - 0,1208 - 0,0011 + 0,1057 - 0,0604 - 0,0318$



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TABLE (2) Epoch 1842.

	$g^{2,3}$	$g^{3,3}$	$g^{2,1}$	$g^{3,1}$	$h^{1,1}$	$h^{2,1}$	$h^{3,1}$	$h^{1,2}$	$h^{2,2}$	$h^{3,2}$	$g^{2,4}$	$g^{3,4}$	$g^{2,5}$	$g^{3,5}$	$h^{1,5}$	$h^{2,5}$	$h^{3,5}$
from $X, Y$	-0,0163	+0,0365	-0,0123	+0,1571	-0,0689	+0,0405	+0,0232	+0,0323	-0,0019	+0,0104	+0,0194						
" $Z$	-0,0222	+0,0211	+0,0086	+0,1152	-0,0707	+0,0470	+0,0060	+0,0232	+0,0023	+0,0116	+0,0192						
	$h^{1,3}$	$h^{2,3}$	$h^{3,3}$	$g^{2,6}$	$g^{3,6}$	$h^{1,6}$	$h^{2,6}$										
" $X, Y$	+0,0023	+0,0188	+0,0249	-0,0043	-0,0042	-0,0037	-0,0080										
" $Z$	+0,0126	+0,0023	-0,0043	-0,0114	-0,0044	-0,0049	-0,0285										

TABLE (3). Epoch 1885.

	$g^{4,0}$	$g^{3,0}$	$g^{2,0}$	$g^{1,0}$	$g^{4,1}$	$g^{3,1}$	$g^{2,1}$	$g^{1,1}$	$h^{1,1}$	$h^{2,1}$	$h^{3,1}$	$h^{4,1}$	$h^{1,2}$	$h^{2,2}$	$h^{3,2}$	$h^{4,2}$	$h^{1,3}$	$h^{2,3}$	$h^{3,3}$	$h^{4,3}$	$g^{4,4}$	$g^{3,4}$	$g^{2,4}$	$g^{1,4}$	$g^{4,5}$	$g^{3,5}$	$g^{2,5}$	$g^{1,5}$	$h^{1,5}$	$h^{2,5}$	$h^{3,5}$	$h^{4,5}$	
" $X$	+3,1774	+4,0705	-0,2214	-0,3775	+0,1266	-0,1300																											
" $Z$	+3,1419	+0,0385	-0,2631	-0,4164	+0,0971	-0,1205																											
	$g^{4,2}$	$g^{3,2}$	$g^{2,2}$	$g^{1,2}$	$g^{4,3}$	$g^{3,3}$	$g^{2,3}$	$g^{1,3}$	$h^{1,3}$	$h^{2,3}$	$h^{3,3}$	$h^{4,3}$	$h^{1,4}$	$h^{2,4}$	$h^{3,4}$	$h^{4,4}$	$h^{1,5}$	$h^{2,5}$	$h^{3,5}$	$h^{4,5}$													
" $X, Y$	+0,2227	-0,4901	+0,3421	-0,2904	-0,3602	-0,1234	-0,5892	+0,1266	+0,0018	-0,1076	+0,3653																						
" $Z$	+0,2475	-0,5045	+0,4305	-0,3276	-0,1831	-0,2307	-0,6001	+0,1315	+0,1232	-0,1656	+0,3997																						
	$h^{1,4}$	$h^{2,4}$	$h^{3,4}$	$h^{4,4}$	$g^{4,6}$	$g^{3,6}$	$g^{2,6}$	$g^{1,6}$	$h^{1,6}$	$h^{2,6}$	$h^{3,6}$	$h^{4,6}$	$h^{1,7}$	$h^{2,7}$	$h^{3,7}$	$h^{4,7}$	$h^{1,8}$	$h^{2,8}$	$h^{3,8}$	$h^{4,8}$													
" $X, Y$	-0,1978	-0,0537	-0,2544	-0,2215	-0,2265	+0,0226	-0,1190	-0,0095	+0,0571	-0,0059	-0,0582																						
" $Z$	-0,1674	-0,0647	-0,2340	-0,1965	-0,1514	+0,1020	-0,1291	+0,0096	+0,0260	+0,0278	-0,1755																						
	$g^{4,7}$	$g^{3,7}$	$g^{2,7}$	$g^{1,7}$	$h^{1,7}$	$h^{2,7}$	$h^{3,7}$	$h^{4,7}$	$g^{4,8}$	$g^{3,8}$	$g^{2,8}$	$g^{1,8}$	$h^{1,8}$	$h^{2,8}$	$h^{3,8}$	$h^{4,8}$	$g^{4,9}$	$g^{3,9}$	$g^{2,9}$	$g^{1,9}$	$h^{1,9}$	$h^{2,9}$	$h^{3,9}$	$h^{4,9}$									
" $X, Y$	-0,0335	+0,0577	-0,0303	+0,1248	-0,0495	+0,0411	+0,0018	+0,0712	-0,0095	+0,0166	+0,0254																						
" $Z$	-0,0378	+0,0645	-0,0428	+0,1905	-0,0610	+0,0685	-0,0226	+0,0830	-0,0027	+0,0034	+0,0129																						
	$h^{1,9}$	$h^{2,9}$	$h^{3,9}$	$h^{4,9}$	$g^{4,9}$	$g^{3,9}$	$g^{2,9}$	$g^{1,9}$	$h^{1,9}$	$h^{2,9}$	$h^{3,9}$	$h^{4,9}$																					
" $X, Y$	+0,0134	+0,0146	+0,0316	-0,0062	-0,0152	-0,0038	-0,0144																										
" $Z$	+0,0067	+0,0115	+0,0379	-0,0066	+0,0126	-0,0049	-0,0241																										

If according to Gauss, one calls the potential divided by the Earth's radius  $R$ ,  $= P_1' + P_2' + P_3' + P_4' + P_5'$ , and if one sets the term corresponding to the outer forces  $= P_1'' + P_2'' + P_3'' + P_4'' + P_5''$ , if  $\pi_k' \pi_k'' \pi_k''' \pi_k^{(4)} \pi_k^{(5)} \pi_k^{(6)}$  which are only the sums derived from the (observed) horizontal components  $X, Y$  of the potential, divided by  $R$ , and if finally  $P_1' P_2' P_3' P_4' P_5'$  are the sums determined with the (observed) vertical component  $Z$  of the potential, divided by  $R$ , then one obtains formulas (4)

$$P_1' = \frac{1}{3}(\pi_k' - P_1'), P_2' = \frac{1}{3}(\pi_k'' - P_2''), P_3' = \frac{1}{3}(\pi_k''' - P_3'''), P_4' = \frac{1}{3}(\pi_k^{(4)} - P_4^{(4)}), \\ P_5' = \frac{1}{3}(\pi_k^{(5)} - P_5^{(5)}), P_6' = \frac{1}{3}(\pi_k^{(6)} - P_6^{(6)}).$$

formula (5)

$$P_1' = \pi_k' - P_1', P_2' = \pi_k'' - P_2'', P_3' = \pi_k''' - P_3''', etc.$$

If one now subtracts the values  $g/2$  in (2) and (3) from one another, then one obtains the differences  $d$  and  $d$ , which are given in the following table (6).

According to the above equations, one then obtains the quantities  $p'p''p'''...$  and  $p'p''p'''...$  and in this way, the coefficients  $g/2$  of both the outer and inner forces of Table (6)

$$\begin{array}{l} p' \quad g^{10} \quad g^{11} \quad h^{11} \\ 1842 \quad d + 0.0355 + 0.0037 - 0.0222 \\ 1885 \quad d + 0.0355 - 0.0248 + 0.0109 \\ \text{average } m + 0.0355 - 0.0105 - 0.0056 \\ g_a h_a + 0.0217 - 0.0070 - 0.0038 = \frac{1}{2} m \quad \text{according to} \\ g_i h_i + 1.1876 + 0.2558 - 0.5932 \text{ calculated } p' = \frac{p''}{h} - p' \end{array}$$

$$\begin{array}{l} p'' \quad g^{20} \quad g^{21} \quad h^{21} \quad g^{22} \quad h^{22} \\ 1842 \quad d - 0.0003 + 0.0019 - 0.0042 - 0.0033 + 0.0108 \\ 1885 \quad d + 0.0320 + 0.0144 - 0.0049 + 0.0110 + 0.0101 \\ \text{average } m + 0.0155 + 0.0081 - 0.0045 + 0.0038 + 0.0104 \\ g_a h_a + 0.0023 + 0.0049 - 0.0027 + 0.0023 + 0.0061 = \frac{1}{2} m \quad \text{according to} \\ g_i h_i + 0.0251 - 0.5879 + 0.0770 - 0.0330 - 0.1207 \text{ cal. } p'' = \frac{p''}{h} - p'' \end{array}$$

$$\begin{array}{l} p''' \quad g^{30} \quad g^{31} \quad h^{31} \quad g^{32} \quad h^{32} \quad g^{33} \quad h^{33} \\ 1842 \quad d - 0.0136 - 0.0223 - 0.0311 + 0.0310 + 0.0036 + 0.0059 + 0.0018 \\ 1885 \quad d + 0.0477 - 0.0224 - 0.0414 + 0.0236 - 0.0191 + 0.0043 + 0.0115 \\ \text{average } m + 0.0170 - 0.0583 - 0.0362 + 0.0303 - 0.0077 + 0.0057 + 0.0066 \\ g_a h_a + 0.0097 - 0.0333 - 0.0207 + 0.0173 - 0.0044 + 0.0029 + 0.0038 = \frac{1}{2} m \quad \text{according to} \\ g_i h_i - 0.2316 + 0.3659 + 0.1170 - 0.2703 - 0.0191 - 0.0278 - 0.0630 \text{ cal. } p''' = \frac{p'''}{h} - p''' \end{array}$$

$$\begin{array}{l} p^{IV} \quad g^{40} \quad g^{41} \quad h^{41} \quad g^{42} \quad h^{42} \quad g^{43} \quad h^{43} \quad g^{44} \quad h^{44} \\ 1842 \quad d - 0.0002 + 0.0029 - 0.0153 - 0.0323 - 0.0166 + 0.0152 - 0.0065 - 0.0042 - 0.0043 \\ 1885 \quad d + 0.0389 + 0.0372 + 0.0580 - 0.0260 - 0.0319 - 0.0068 - 0.0274 - 0.0069 + 0.0069 \\ \text{average } m + 0.0190 + 0.0600 + 0.0213 - 0.0234 - 0.0262 + 0.0042 - 0.0170 - 0.0055 + 0.0012 \\ g_a h_a + 0.0106 + 0.0333 + 0.0112 - 0.0163 - 0.0134 + 0.0023 - 0.0094 - 0.0031 + 0.0007 = \frac{1}{2} m \quad \text{according to} \\ g_i h_i - 0.3461 - 0.3223 - 0.0976 - 0.1832 + 0.0840 + 0.0648 + 0.0502 - 0.0026 + 0.0101 \text{ cal. } p^{IV} = \frac{p^{IV}}{h} - p^{IV} \end{array}$$

$$\begin{array}{l} p^{V} \quad g^{50} \quad g^{51} \quad h^{51} \quad g^{52} \quad h^{52} \quad g^{53} \quad h^{53} \quad g^{54} \quad h^{54} \quad g^{55} \quad h^{55} \\ 1842 \quad d + 0.1785 - 0.1400 + 0.0226 + 0.0166 + 0.0659 - 0.0209 + 0.0232 - 0.0012 + 0.0105 + 0.0071 + 0.0012 \\ 1885 \quad d + 0.0295 - 0.1711 - 0.0304 - 0.0751 - 0.0737 + 0.0125 + 0.0244 + 0.0072 + 0.0031 + 0.0004 + 0.0011 \\ \text{average } m + 0.1040 - 0.1555 - 0.0059 - 0.0222 - 0.0139 - 0.0042 + 0.0238 + 0.0030 + 0.0068 + 0.0037 + 0.0011 \\ g_a h_a + 0.0567 - 0.0848 - 0.0032 - 0.0189 - 0.0076 - 0.0023 + 0.0130 + 0.0016 + 0.0037 + 0.0020 + 0.0006 \\ g_i h_i + 0.0680 - 0.3142 + 0.3053 - 0.2429 + 0.0034 - 0.0190 + 0.0025 + 0.0119 + 0.0130 - 0.0072 - 0.0043 \end{array}$$

$$\begin{array}{l} p^{VI} \quad g^{60} \quad g^{61} \quad h^{61} \quad g^{62} \quad h^{62} \quad g^{63} \quad h^{63} \quad g^{64} \quad h^{64} \quad g^{65} \quad h^{65} \\ 1842 \quad d - 0.0987 + 0.0212 - 0.1258 - 0.0464 + 0.0065 + 0.0419 - 0.0503 + 0.0002 + 0.0292 - 0.0038 + 0.0205 \\ 1885 \quad d - 0.0035 + 0.1023 - 0.0324 - 0.0794 + 0.1173 - 0.0657 - 0.0108 + 0.0125 - 0.0063 - 0.0278 + 0.0037 \\ \text{average } m - 0.0541 + 0.0617 - 0.0791 - 0.0629 + 0.0619 - 0.0119 - 0.0305 + 0.0063 + 0.0114 - 0.0158 + 0.0151 \\ g_a h_a - 0.0291 + 0.0332 - 0.0426 - 0.0339 + 0.0333 - 0.0064 - 0.0164 + 0.0034 + 0.0061 - 0.0015 + 0.0081 \\ g_i h_i - 0.0772 - 0.1549 - 0.1037 + 0.0896 - 0.0750 + 0.1474 + 0.0689 + 0.0190 + 0.0222 - 0.0017 - 0.0193 \end{array}$$

There are more or less serious determination errors connected with the coefficients  $g_a h_a$  of the outer forces. It seems that the first coefficient  $g^{10}$  has the most certainty, which here was calculated using the averages  $k_0$  and  $m_0$  of the parallel circles (for epoch 1842 from 12 equidistant values, for epoch 1885 from 24 equidistant values of X and Z), because  $k_0$  and  $m_0$  are determined somewhat



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more accurately from observations than the other coefficients  $k_1, m, K, L, M$  of the series  $X = \kappa_0 + \kappa_1 \cos \lambda + \kappa_2 \sin \lambda + \kappa_3 \cos 2\lambda - \dots$

$$Y = \gamma_0 + \gamma_1 \cos \lambda + \gamma_2 \sin \lambda + \gamma_3 \cos 2\lambda + \gamma_4 \sin 2\lambda + \dots, \quad Z = m_0 + m_1 \cos \lambda + m_2 \sin \lambda + m_3 \cos 2\lambda + \dots$$

This is also because  $g^{1,0}$  is smaller by the same amount 0.0355 for both epochs 1842 and 1845 when determined from Z and from X. If one were only to consider the  $g^{1,0} = 0.0237$ , if one were to ignore all other external forces, then the outer magnetic force divided by the inner magnetic force would be at a ratio of 1:135. In order to establish the size of the outer forces and their ratios to the inner forces, at least approximately without a cumbersome calculation, on the average for the entire Earth, I have collected the primitive equations on page 13 in the following in Publication I in the following way by only considering the numerical values of the coefficients of gh, but not their sign. In this way, I obtained: formula (7) equations

$$\begin{aligned} (X)_0 & \pm 0.679^{1,0} \pm 0.679^{2,0} \pm 0.519^{3,0} \pm 0.139^{4,0} \pm 0.219^{5,0} \pm 0.139^{6,0} = \kappa_0, = K_0 \\ (X)_1 & \pm 0.619^{1,1} \pm 0.629^{2,1} \pm 0.459^{3,1} \pm 0.319^{4,1} \pm 0.189^{5,1} \pm 0.129^{6,1} = \kappa_1, = K_1 \\ (X)_2 & \pm 0.679^{1,2} \pm 0.629^{2,2} \pm 0.339^{3,2} \pm 0.219^{4,2} \pm 0.129^{5,2} = \kappa_2, = K_2 \\ (X)_3 & \pm 0.679^{1,3} \pm 0.439^{2,3} \pm 0.269^{3,3} \pm 0.159^{4,3} = \kappa_3, = K_3 \\ (X)_4 & \pm 0.679^{1,4} \pm 0.399^{2,4} \pm 0.219^{3,4} = \kappa_4, = K_4 \\ (X)_5 & \pm 0.679^{1,5} \pm 0.359^{2,5} = \kappa_5, = K_5 \end{aligned}$$

The most likely values of  $\kappa_0, \kappa_1, \kappa_2, \kappa_3, \kappa_4, \kappa_5$  are obtained if one substitutes the numerical values of g and h in these equations and the square root is taken from the sum of the squares of the corresponding products. For example,  $\kappa_0 = \sqrt{(0.679^{1,0})^2 + (0.679^{2,0})^2 + \dots}$ . The most likely values of the northern component  $X_n$  of the outer magnetic forces is, therefore,  $X_n = \sqrt{\kappa_0^2 + (0.62)^2(\kappa_1^2 + \kappa_2^2 + \kappa_3^2 + \kappa_4^2 + \kappa_5^2 + \kappa_6^2 + \kappa_7^2 + \kappa_8^2 + \kappa_9^2)}$ , because the average value of  $\cos nX$  and  $\sin nX$  is 0.62 according to the scheme that I derived. Therefore, for the outer forces we find  $X_n = 0.0296$ , and for the inner forces the northern component is  $X_i = 1.2$ , that is,  $X_n : X_i = 1 : 74$ .

In the same way as for X, from the primitive equations of Publication I page 13, etc., I derived the most likely quantities of the western Y and the vertical component Z for the outer forces.



average. I would like to also note that the components  $X_1$ ,  $Y_1$ ,  $Z_1$  were also calculated according to the approximate method mentioned, by substituting the values  $g, h$  of the inner forces in equations (7), (8) and (9). In this way, I obtained the same quantities  $X_1 = 2.2$ ,  $Y_1 = 0.5$ ,  $Z_1 = 4.2$  as I obtained earlier by complete calculation from 408 locations distributed uniformly over the entire Earth's surface. Therefore, the values  $X_a = 0.0295$ ,  $Y_a = 0.0192$  and  $Z_a = 0.0464$  can be considered as approximately correct.

The calculation which I made according to the Gauss rule of both the inner and outer Earth magnetic forces for the two epochs 1842 and 1885 required no great effort, after I had made the first general calculation which is contained in Publications I and II. This means that also in this case, as in many other cases, one has to admire the ingenuity of Gauss, who always was able to grasp problems he dealt with very well and was able to solve them in a simple way as could nobody else. Here again, the path for determining the Earth's magnetism is not only theoretically correct, but it is also the most practical method because, at the present time, one does not have any more or better absolute measurements than he had in the middle of the 19th Century, even though the number of magnetic observatories and their means have substantially improved compared to earlier times.

/9

B. Earth magnetic elements for the epoch 1550

The values of the coefficients  $g, h$  of the theory for the epoch 1550 are based on the declinations collected by Dr. Van Gemmelen and published in 1897, March 10, by the Academy of Sciences in Amsterdam, as well as the elements which I calculated earlier for the epoch 1600. Using these  $g, h$ , I calculated the cosine and the sine series for determining the northern component  $X_r$ , the western component  $Y_r$  and the vertical component  $Z_r$  given in Tables (10), (11) and (12). And from this I calculated the seven elements  $X, Y, Z, i, f, F, \lambda^*$  contained in Tables (13), (14), (15), (16), (17), (18) and (19). \*

TABLE (10), epoch 1550

$\mu$	$K_0$	$K_1$	$K_2$	$K_3$	$K_4$	$K_5$	$K_6$	$K_7$	$K_8$	$K_9$	$K_{10}$
	$\cos \lambda$	$\sin \lambda$	$\cos 2\lambda$	$\sin 2\lambda$	$\cos 3\lambda$	$\sin 3\lambda$	$\cos 4\lambda$	$\sin 4\lambda$	$\cos 5\lambda$	$\sin 5\lambda$	
10	$X_0 = +0.364 + 0.083 + 0.291 + 0.068 - 0.196 + 0.004 - 0.011 - 0.001$										
20	$X_0 = +0.797 - 0.061 + 0.257 + 0.037 - 0.305 + 0.017 - 0.032 - 0.005$										
30	$X_0 = +1.318 - 0.203 + 0.208 + 0.057 - 0.302 + 0.042 - 0.045 - 0.009$										
40	$X_0 = +1.891 - 0.268 + 0.142 - 0.040 - 0.221 + 0.074 - 0.035 - 0.004$										
50	$X_0 = +2.438 - 0.251 + 0.072 - 0.217 - 0.126 + 0.083 - 0.094 + 0.012$										
60	$X_0 = +2.886 - 0.200 - 0.003 - 0.340 - 0.058 + 0.061 + 0.022 + 0.030$										
70	$X_0 = +3.190 - 0.176 - 0.084 - 0.357 - 0.019 + 0.031 + 0.027 + 0.037$										
80	$X_0 = +3.335 - 0.207 - 0.171 - 0.246 + 0.008 - 0.041 + 0.066 + 0.026$										
90	$X_0 = +3.335 - 0.265 - 0.257 - 0.054 + 0.038 - 0.079 - 0.023 - 0.004$										
100	$X_0 = +3.200 - 0.291 - 0.325 + 0.122 + 0.062 - 0.119 - 0.038 - 0.032$										
110	$X_0 = +2.966 - 0.242 - 0.354 + 0.213 + 0.074 - 0.096 - 0.029 - 0.040$										
120	$X_0 = +2.667 - 0.104 - 0.327 + 0.266 + 0.026 - 0.049 - 0.000 - 0.029$										
130	$X_0 = +2.339 + 0.078 - 0.238 + 0.151 + 0.121 - 0.004 + 0.032$										
140	$X_0 = +1.985 + 0.262 - 0.088 + 0.108 + 0.185 + 0.021 + 0.050$										
150	$X_0 = +1.592 + 0.411 + 0.059 + 0.095 + 0.245 + 0.025 + 0.045$										
160	$X_0 = +1.131 + 0.511 + 0.203 + 0.089 + 0.247 + 0.015 + 0.028$										
170	$X_0 = +0.593 + 0.562 + 0.303 + 0.058 + 0.159 + 0.005 + 0.008$										

TABLE (11), epoch 1550

$\mu$	$X_1$	$X_2$	$X_3$	$X_4$	$X_5$	$X_6$	$X_7$	$X_8$	$X_9$	$X_{10}$
	$\cos \lambda$	$\sin \lambda$	$\cos 2\lambda$	$\sin 2\lambda$	$\cos 3\lambda$	$\sin 3\lambda$	$\cos 4\lambda$	$\sin 4\lambda$	$\cos 5\lambda$	$\sin 5\lambda$
10	$Y_0 = +0.303 - 0.123 - 0.205 - 0.073 - 0.010 - 0.002 - 0.001 + 0.001$									
20	$Y_0 = +0.295 - 0.063 - 0.367 - 0.126 - 0.039 - 0.014 - 0.002 + 0.005$									
30	$Y_0 = +0.203 - 0.001 - 0.470 - 0.145 - 0.070 - 0.038 - 0.007 + 0.013$									
40	$Y_0 = +0.267 + 0.066 - 0.510 - 0.115 - 0.088 - 0.070 - 0.022 + 0.017$									
50	$Y_0 = +0.248 + 0.115 - 0.506 - 0.033 - 0.088 - 0.124 - 0.047 + 0.013$									
60	$Y_0 = +0.228 + 0.147 - 0.484 + 0.068 - 0.072 - 0.164 - 0.080 - 0.006$									
70	$Y_0 = +0.202 + 0.167 - 0.459 + 0.212 - 0.051 - 0.184 - 0.112 - 0.032$									
80	$Y_0 = +0.170 + 0.196 - 0.441 + 0.212 - 0.040 - 0.173 - 0.128 - 0.054$									

\* In Publications I and II as well as in the present Publication III, the following notation applies:  $\lambda$  is the eastern longitude from Greenwich;  $\phi$  is the geographic latitude;  $u$  is the angular separation from astronomical North Pole so that  $\phi + u = 90^\circ$ ;  $\gamma = \frac{J}{R}$  the potential divided by the Earth's radius  $R$ ;  $\gamma = \frac{J}{R} (1 - 2.2)$  the ideal distribution of the magnetism on the Earth's surface;  $X$  is the northern,  $Y$  is the western and  $Z$  is the vertical component.  $\delta$  is the declination,  $i$  is the inclination,  $T$  is the horizontal and  $J$  is the total intensity. When  $X, Y, Z, \delta, i, T$  are calculated according to the theory, then they are called  $X_c, Y_c, Z_c, \delta_c, i_c, T_c$ . When they are observed, they are called  $X_o, Y_o, Z_o, \delta_o, i_o, T_o$ . The units for for intensity are milligram, mm and average seconds.

TABLE (11) Epoch 1550

$u$	$\cos \lambda$	$\sin \lambda$	$\cos 2\lambda$	$\sin 2\lambda$	$\cos 3\lambda$	$\sin 3\lambda$	$\cos 4\lambda$	$\sin 4\lambda$	$\cos 5\lambda$	$\sin 5\lambda$
90	$Y_r = +0.130 + 0.233$	$-0.426 + 0.360$	$-0.043$	$-0.132$	$-0.123$	$-0.062$	$+0.141$	$-0.025$		
100	$Y_r = +0.080 + 0.288$	$-0.414 + 0.352$	$-0.062$	$-0.075$	$-0.076$	$-0.049$	$+0.115$	$-0.015$		
110	$Y_r = +0.020 + 0.352$	$-0.407 + 0.304$	$-0.024$	$-0.016$	$-0.055$	$-0.023$	$+0.080$	$-0.006$		
120	$Y_r = -0.048 + 0.419$	$-0.410 + 0.241$	$-0.101$	$+0.025$	$-0.166$	$+0.004$	$+0.048$	$+0.001$		
130	$Y_r = -0.120 + 0.477$	$-0.418 + 0.193$	$-0.183$	$+0.046$	$-0.211$	$+0.022$	$+0.024$	$+0.002$		
140	$Y_r = -0.189 + 0.522$	$-0.416 + 0.161$	$-0.287$	$+0.046$	$-0.218$	$+0.024$	$+0.009$	$+0.003$		
150	$Y_r = -0.251 + 0.552$	$-0.382 + 0.139$	$-0.400$	$+0.033$	$-0.214$	$+0.016$	$+0.003$	$+0.001$		
160	$Y_r = -0.299 + 0.568$	$-0.299 + 0.110$	$-0.430$	$+0.016$	$-0.206$	$+0.006$	$+0.001$	$+0.001$		
170	$Y_r = -0.329 + 0.577$	$-0.167 + 0.061$	$-0.407$	$+0.004$	$-0.201$	$+0.001$	$+0.000$	$+0.000$		

TABLE (12) Epoch 1550

$u$	$m_1$	$m_2$	$M_1$	$M_2$	$m_3$	$M_3$	$m_4$	$M_4$	$m_5$	$M_5$
	$\cos \lambda$	$\sin \lambda$	$\cos 2\lambda$	$\sin 2\lambda$	$\cos 3\lambda$	$\sin 3\lambda$	$\cos 4\lambda$	$\sin 4\lambda$	$\cos 5\lambda$	$\sin 5\lambda$
10	$Z_r = +5.823$	$-0.180$	$-0.133$	$-0.034 + 0.072$	$+0.000$	$+0.004$	$+0.000$	$+0.000$	$+0.000$	$+0.000$
20	$Z_r = +5.758$	$-0.254$	$-0.255$	$-0.121$	$+0.170$	$-0.003$	$+0.026$	$+0.004$	$+0.000$	$-0.002$
30	$Z_r = +5.546$	$-0.187$	$-0.354$	$-0.220$	$+0.479$	$-0.017$	$+0.067$	$+0.013$	$+0.002$	$-0.003$
40	$Z_r = +5.095$	$-0.029$	$-0.424$	$-0.265$	$+0.617$	$-0.057$	$+0.106$	$+0.024$	$+0.011$	$-0.009$
50	$Z_r = +4.378$	$+0.125$	$-0.470$	$-0.193$	$+0.666$	$-0.128$	$+0.117$	$+0.025$	$+0.040$	$-0.020$
60	$Z_r = +3.422$	$+0.217$	$-0.484$	$+0.014$	$+0.656$	$-0.208$	$+0.077$	$+0.003$	$+0.085$	$-0.033$
70	$Z_r = +2.295$	$+0.250$	$-0.473$	$+0.295$	$+0.632$	$-0.260$	$+0.057$	$-0.035$	$+0.135$	$-0.040$
80	$Z_r = +1.090$	$+0.286$	$-0.421$	$+0.540$	$+0.615$	$-0.256$	$+0.030$	$-0.075$	$+0.168$	$-0.040$
90	$Z_r = -0.124$	$+0.381$	$-0.324$	$+0.646$	$+0.595$	$-0.188$	$+0.036$	$-0.083$	$+0.163$	$-0.010$
100	$Z_r = -1.286$	$+0.549$	$-0.175$	$+0.590$	$+0.565$	$-0.086$	$+0.072$	$-0.067$	$+0.119$	$-0.017$
110	$Z_r = -2.349$	$+0.744$	$+0.013$	$+0.431$	$+0.539$	$+0.012$	$+0.115$	$-0.024$	$+0.055$	$-0.003$
120	$Z_r = -3.291$	$+0.890$	$+0.212$	$+0.270$	$+0.529$	$+0.062$	$+0.138$	$+0.017$	$+0.001$	$-0.003$
130	$Z_r = -4.108$	$+0.935$	$+0.380$	$+0.171$	$+0.528$	$+0.079$	$+0.129$	$+0.035$	$-0.027$	$+0.004$
140	$Z_r = -4.826$	$+0.862$	$+0.478$	$+0.137$	$+0.491$	$+0.059$	$+0.094$	$+0.030$	$-0.026$	$+0.003$
150	$Z_r = -5.456$	$+0.699$	$+0.482$	$+0.116$	$+0.384$	$+0.031$	$+0.051$	$+0.015$	$-0.014$	$+0.001$
160	$Z_r = -5.973$	$+0.483$	$+0.389$	$+0.075$	$+0.219$	$+0.011$	$+0.017$	$+0.004$	$-0.004$	$+0.000$
170	$Z_r = -6.325$	$+0.244$	$+0.215$	$+0.024$	$+0.065$	$+0.002$	$+0.003$	$+0.000$	$-0.000$	$+0.000$

TABLE (20) Epoch 1550

Different  $\delta_r - \delta_z$  between the declination calculated according to the theory  $\delta_r$  and the observed  $\delta_r$  (cf. given here under the following table (16))

$\varphi$	$\lambda = 0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$
+60	-0.3	+0.4								+2.9	+0.7
+50	-0.7	-0.8	+0.7							-4.1	-0.6
+40	-0.7	-2.3	-0.9	+3						-3.1	0.0
+30	-0.7	-2.7	-0.6	+1	+5.2					+1.2	+1.3
+20	-0.8	-2.6	-1.0	+3.6	+5.8					+2.7	+0.9
+10	-1.5	-3.1	-1.2	+3.1	+4.1	+4.4				-0.3	-0.4
0	-1.3	-2.3	-0.8	+2.8	+3.5	+3.8				-0.8	-0.4
-10	+0.5	-0.9	+0.2	+2.3	+3.3						+1.3
-20	+1.9	+0.3	+1.0	+1.8	+2.3						+1.7
-30	+2.4	+1.1	+1.6	+0.7	+0.7						+1.3
-40	+2.6	+1.7	+2.4	-0.3							+0.2

On the average, for these 80 values we have  $\delta_r - \delta_z = 1.68$  whereas for the epoch 1600, 1650, 1700, 1780 the averages are 2.17



Table (13). epoch 1550. northern component  $X_c$  according to the theory. For  $\varphi = +90^\circ$   
we have  $\delta = 64^\circ 51' 14''$ ,  $X_c = 0.3367 \sin \delta$ ,  $\gamma = 0.3367 \sin \delta$ . For  $\varphi = -90^\circ$  we have  
 $\delta = \lambda - 30^\circ 22'$ ,  $X_c = 0.674 \sin \delta$ ,  $\gamma = 0.674 \sin \delta$ . The values  $X_c$  without a sign are positive

$\varphi$	$\lambda = 0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$
+90	0.45	0.817	0.936	0.974	0.992	0.998	1.000	0.998	0.992	0.974	0.936	0.817	0.45	0.000	-0.45	-0.936	-0.974	-0.992	-0.998	-0.998	-0.992	-0.974	-0.817	-0.45
+80	0.514	0.945	0.954	0.963	0.969	0.974	0.978	0.981	0.983	0.984	0.985	0.986	0.987	0.988	0.989	0.990	0.991	0.992	0.993	0.994	0.995	0.996	0.997	0.998
+70	0.564	0.975	0.964	0.953	0.942	0.931	0.920	0.909	0.898	0.887	0.876	0.865	0.854	0.843	0.832	0.821	0.810	0.799	0.788	0.777	0.766	0.755	0.744	0.733
+60	0.608	0.944	0.913	0.882	0.851	0.820	0.789	0.758	0.727	0.696	0.665	0.634	0.603	0.572	0.541	0.510	0.479	0.448	0.417	0.386	0.355	0.324	0.293	0.262
+50	0.647	0.892	0.841	0.790	0.739	0.688	0.637	0.586	0.535	0.484	0.433	0.382	0.331	0.280	0.229	0.178	0.127	0.076	0.025	-0.026	-0.077	-0.128	-0.179	-0.230
+40	0.681	0.817	0.746	0.675	0.604	0.533	0.462	0.391	0.320	0.249	0.178	0.107	0.036	-0.035	-0.106	-0.177	-0.248	-0.319	-0.390	-0.461	-0.532	-0.603	-0.674	-0.745
+30	0.710	0.723	0.628	0.533	0.438	0.343	0.248	0.153	0.058	-0.037	-0.142	-0.247	-0.352	-0.457	-0.562	-0.667	-0.772	-0.877	-0.982	-1.087	-1.192	-1.297	-1.402	-1.507
+20	0.734	0.643	0.548	0.453	0.358	0.263	0.168	0.073	-0.022	-0.127	-0.232	-0.337	-0.442	-0.547	-0.652	-0.757	-0.862	-0.967	-1.072	-1.177	-1.282	-1.387	-1.492	-1.597
+10	0.753	0.602	0.507	0.412	0.317	0.222	0.127	0.032	-0.063	-0.168	-0.273	-0.378	-0.483	-0.588	-0.693	-0.798	-0.903	-1.008	-1.113	-1.218	-1.323	-1.428	-1.533	-1.638
0	0.767	0.562	0.467	0.372	0.277	0.182	0.087	-0.008	-0.113	-0.218	-0.323	-0.428	-0.533	-0.638	-0.743	-0.848	-0.953	-1.058	-1.163	-1.268	-1.373	-1.478	-1.583	-1.688
-10	0.776	0.517	0.422	0.327	0.232	0.137	0.042	-0.053	-0.158	-0.263	-0.368	-0.473	-0.578	-0.683	-0.788	-0.893	-1.000	-1.105	-1.210	-1.315	-1.420	-1.525	-1.630	-1.735
-20	0.781	0.472	0.377	0.282	0.187	0.092	-0.003	-0.108	-0.213	-0.318	-0.423	-0.528	-0.633	-0.738	-0.843	-0.948	-1.053	-1.158	-1.263	-1.368	-1.473	-1.578	-1.683	-1.788
-30	0.784	0.427	0.332	0.237	0.142	0.047	-0.058	-0.163	-0.268	-0.373	-0.478	-0.583	-0.688	-0.793	-0.898	-1.003	-1.108	-1.213	-1.318	-1.423	-1.528	-1.633	-1.738	-1.843
-40	0.786	0.382	0.287	0.192	0.097	0.002	-0.093	-0.198	-0.303	-0.408	-0.513	-0.618	-0.723	-0.828	-0.933	-1.038	-1.143	-1.248	-1.353	-1.458	-1.563	-1.668	-1.773	-1.878
-50	0.787	0.337	0.242	0.147	0.052	-0.043	-0.148	-0.253	-0.358	-0.463	-0.568	-0.673	-0.778	-0.883	-0.988	-1.093	-1.198	-1.303	-1.408	-1.513	-1.618	-1.723	-1.828	-1.933
-60	0.788	0.292	0.197	0.102	0.007	-0.092	-0.197	-0.302	-0.407	-0.512	-0.617	-0.722	-0.827	-0.932	-1.037	-1.142	-1.247	-1.352	-1.457	-1.562	-1.667	-1.772	-1.877	-1.982
-70	0.789	0.247	0.152	0.057	-0.038	-0.143	-0.248	-0.353	-0.458	-0.563	-0.668	-0.773	-0.878	-0.983	-1.088	-1.193	-1.298	-1.403	-1.508	-1.613	-1.718	-1.823	-1.928	-2.033
-80	0.790	0.202	0.107	0.012	-0.083	-0.188	-0.293	-0.398	-0.503	-0.608	-0.713	-0.818	-0.923	-1.028	-1.133	-1.238	-1.343	-1.448	-1.553	-1.658	-1.763	-1.868	-1.973	-2.078
-90	0.791	0.157	0.062	-0.033	-0.138	-0.243	-0.348	-0.453	-0.558	-0.663	-0.768	-0.873	-0.978	-1.083	-1.188	-1.293	-1.398	-1.503	-1.608	-1.713	-1.818	-1.923	-2.028	-2.133

Table (14) epoch 1550. Western component  $Y$  calculated according to theory. Units of the third decimal

$\varphi$	$\lambda = 0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$
+90	+2.65	+2.57	+2.49	+2.41	+2.33	+2.25	+2.17	+2.09	+2.01	+1.93	+1.85	+1.77	+1.69	+1.61	+1.53	+1.45	+1.37	+1.29	+1.21	+1.13	+1.05	+0.97	+0.89	+0.81
+80	+2.87	+2.79	+2.71	+2.63	+2.55	+2.47	+2.39	+2.31	+2.23	+2.15	+2.07	+1.99	+1.91	+1.83	+1.75	+1.67	+1.59	+1.51	+1.43	+1.35	+1.27	+1.19	+1.11	+1.03
+70	+3.10	+3.02	+2.94	+2.86	+2.78	+2.70	+2.62	+2.54	+2.46	+2.38	+2.30	+2.22	+2.14	+2.06	+1.98	+1.90	+1.82	+1.74	+1.66	+1.58	+1.50	+1.42	+1.34	+1.26
+60	+3.33	+3.25	+3.17	+3.09	+3.01	+2.93	+2.85	+2.77	+2.69	+2.61	+2.53	+2.45	+2.37	+2.29	+2.21	+2.13	+2.05	+1.97	+1.89	+1.81	+1.73	+1.65	+1.57	+1.49
+50	+3.56	+3.48	+3.40	+3.32	+3.24	+3.16	+3.08	+3.00	+2.92	+2.84	+2.76	+2.68	+2.60	+2.52	+2.44	+2.36	+2.28	+2.20	+2.12	+2.04	+1.96	+1.88	+1.80	+1.72
+40	+3.79	+3.71	+3.63	+3.55	+3.47	+3.39	+3.31	+3.23	+3.15	+3.07	+2.99	+2.91	+2.83	+2.75	+2.67	+2.59	+2.51	+2.43	+2.35	+2.27	+2.19	+2.11	+2.03	+1.95
+30	+4.02	+3.94	+3.86	+3.78	+3.70	+3.62	+3.54	+3.46	+3.38	+3.30	+3.22	+3.14	+3.06	+2.98	+2.90	+2.82	+2.74	+2.66	+2.58	+2.50	+2.42	+2.34	+2.26	+2.18
+20	+4.25	+4.17	+4.09	+4.01	+3.93	+3.85	+3.77	+3.69	+3.61	+3.53	+3.45	+3.37	+3.29	+3.21	+3.13	+3.05	+2.97	+2.89	+2.81	+2.73	+2.65	+2.57	+2.49	+2.41
+10	+4.48	+4.40	+4.32	+4.24	+4.16	+4.08	+4.00	+3.92	+3.84	+3.76	+3.68	+3.60	+3.52	+3.44	+3.36	+3.28	+3.20	+3.12	+3.04	+2.96	+2.88	+2.80	+2.72	+2.64
0	+4.71	+4.63	+4.55	+4.47	+4.39	+4.31	+4.23	+4.15	+4.07	+3.99	+3.91	+3.83	+3.75	+3.67	+3.59	+3.51	+3.43	+3.35	+3.27	+3.19	+3.11	+3.03	+2.95	+2.87
-10	+4.94	+4.86	+4.78	+4.70	+4.62	+4.54	+4.46	+4.38	+4.30	+4.22	+4.14	+4.06	+3.98	+3.90	+3.82	+3.74	+3.66	+3.58	+3.50	+3.42	+3.34	+3.26	+3.18	+3.10
-20	+5.17	+5.09	+5.01	+4.93	+4.85	+4.77	+4.69	+4.61	+4.53	+4.45	+4.37	+4.29	+4.21	+4.13	+4.05	+3.97	+3.89	+3.81	+3.73	+3.65	+3.57	+3.49	+3.41	+3.33
-30	+5.40	+5.32	+5.24	+5.16	+5.08	+5.00	+4.92	+4.84	+4.76	+4.68	+4.60	+4.52	+4.44	+4.36	+4.28	+4.20	+4.12	+4.04	+3.96	+3.88	+3.80	+3.72	+3.64	+3.56
-40	+5.63	+5.55	+5.47	+5.39	+5.31	+5.23	+5.15	+5.07	+4.99	+4.91	+4.83	+4.75	+4.67	+4.59	+4.51	+4.43	+4.35	+4.27	+4.19	+4.11	+4.03	+3.95	+3.87	+3.79
-50	+5.86	+5.78	+5.70	+5.62	+5.54	+5.46	+5.38	+5.30	+5.22	+5.14	+5.06	+4.98	+4.90	+4.82	+4.74	+4.66	+4.58	+4.50	+4.42	+4.34	+4.26	+4.18	+4.10	+4.02
-60	+6.09	+6.01	+5.93	+5.85	+5.77	+5.69	+5.61	+5.53	+5.45	+5.37	+5.29	+5.21	+5.13	+5.05	+4.97	+4.89	+4.81	+4.73	+4.65	+4.57	+4.49	+4.41	+4.33	+4.25
-70	+6.32	+6.24	+6.16	+6.08	+6.00	+5.92	+5.84	+5.76	+5.68	+5.60	+5.52	+5.44	+5.36	+5.28	+5.20	+5.12	+5.04	+4.96	+4.88	+4.80	+4.72	+4.64	+4.56	+4.48
-80	+6.55	+6.47	+6.39	+6.31	+6.23	+6.15	+6.07	+5.99	+5.91	+5.83	+5.75	+5.67	+5.59	+5.51	+5.43	+5.35	+5.27	+5.19	+5.11	+5.03	+4.95	+4.87	+4.79	+4.71
-90	+6.78	+6.70	+6.62	+6.54	+6.46	+6.38	+6.30	+6.22	+6.14	+6.06	+5.98	+5.90	+5.82	+5.74	+5.66	+5.58	+5.50	+5.42	+5.34	+5.26	+5.18	+5.10	+5.02	+4.94

Table (15) epoch 1550. Vertical component  $Z_r$  calculated with theory. The values without side are positive. For  $\varphi = +90^\circ$  we have  $Z_r = +5.11$ , for  $\varphi = -90^\circ$  we have  $Z_r = -2.45$ .

Table (16) epoch 1550. Declination  $\delta$  according to theory. Degrees in minutes are separated by dots.

Table (16) epoch 1550. Declination  $\delta$  according to theory. Degrees in minutes are separated by dots.

TABLE (16) epoch 1550 Declination  $\delta_r$  calculated according to theory

$\lambda = 0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$
$-6.19$	$-5.32$	$-4.46$	$-3.61$	$-2.76$	$-1.91$	$-1.06$	$-0.21$	$0.64$	$1.49$	$2.34$	$3.19$	$4.04$	$4.89$	$5.74$	$6.59$	$7.44$	$8.29$	$9.14$	$10.00$	$10.85$	$11.70$	$12.55$	$13.40$
$-7.29$	$-6.42$	$-5.56$	$-4.71$	$-3.86$	$-3.01$	$-2.16$	$-1.31$	$-0.46$	$0.39$	$1.24$	$2.09$	$2.94$	$3.79$	$4.64$	$5.49$	$6.34$	$7.19$	$8.04$	$8.89$	$9.74$	$10.59$	$11.44$	$12.29$
$-8.39$	$-7.52$	$-6.66$	$-5.81$	$-4.96$	$-4.11$	$-3.26$	$-2.41$	$-1.56$	$-0.71$	$0.14$	$0.99$	$1.84$	$2.69$	$3.54$	$4.39$	$5.24$	$6.09$	$6.94$	$7.79$	$8.64$	$9.49$	$10.34$	$11.19$
$-9.49$	$-8.62$	$-7.76$	$-6.91$	$-6.06$	$-5.21$	$-4.36$	$-3.51$	$-2.66$	$-1.81$	$-0.96$	$-0.11$	$0.74$	$1.59$	$2.44$	$3.29$	$4.14$	$4.99$	$5.84$	$6.69$	$7.54$	$8.39$	$9.24$	$10.09$
$-10.59$	$-9.72$	$-8.86$	$-8.01$	$-7.16$	$-6.31$	$-5.46$	$-4.61$	$-3.76$	$-2.91$	$-2.06$	$-1.21$	$-0.36$	$0.49$	$1.34$	$2.19$	$3.04$	$3.89$	$4.74$	$5.59$	$6.44$	$7.29$	$8.14$	$8.99$
$-11.69$	$-10.82$	$-9.96$	$-9.11$	$-8.26$	$-7.41$	$-6.56$	$-5.71$	$-4.86$	$-4.01$	$-3.16$	$-2.31$	$-1.46$	$-0.61$	$0.24$	$1.09$	$1.94$	$2.79$	$3.64$	$4.49$	$5.34$	$6.19$	$7.04$	$7.89$
$-12.79$	$-11.92$	$-11.06$	$-10.21$	$-9.36$	$-8.51$	$-7.66$	$-6.81$	$-5.96$	$-5.11$	$-4.26$	$-3.41$	$-2.56$	$-1.71$	$-0.86$	$0.01$	$0.86$	$1.71$	$2.56$	$3.41$	$4.26$	$5.11$	$5.96$	$6.81$
$-13.89$	$-13.02$	$-12.16$	$-11.31$	$-10.46$	$-9.61$	$-8.76$	$-7.91$	$-7.06$	$-6.21$	$-5.36$	$-4.51$	$-3.66$	$-2.81$	$-1.96$	$-1.11$	$-0.26$	$0.59$	$1.44$	$2.29$	$3.14$	$3.99$	$4.84$	$5.69$
$-14.99$	$-14.12$	$-13.26$	$-12.41$	$-11.56$	$-10.71$	$-9.86$	$-9.01$	$-8.16$	$-7.31$	$-6.46$	$-5.61$	$-4.76$	$-3.91$	$-3.06$	$-2.21$	$-1.36$	$-0.51$	$0.34$	$1.19$	$2.04$	$2.89$	$3.74$	$4.59$
$-16.09$	$-15.22$	$-14.36$	$-13.51$	$-12.66$	$-11.81$	$-10.96$	$-10.11$	$-9.26$	$-8.41$	$-7.56$	$-6.71$	$-5.86$	$-5.01$	$-4.16$	$-3.31$	$-2.46$	$-1.61$	$-0.76$	$0.09$	$0.94$	$1.79$	$2.64$	$3.49$
$-17.19$	$-16.32$	$-15.46$	$-14.61$	$-13.76$	$-12.91$	$-12.06$	$-11.21$	$-10.36$	$-9.51$	$-8.66$	$-7.81$	$-6.96$	$-6.11$	$-5.26$	$-4.41$	$-3.56$	$-2.71$	$-1.86$	$-1.01$	$-0.16$	$0.69$	$1.54$	$2.39$
$-18.29$	$-17.42$	$-16.56$	$-15.71$	$-14.86$	$-14.01$	$-13.16$	$-12.31$	$-11.46$	$-10.61$	$-9.76$	$-8.91$	$-8.06$	$-7.21$	$-6.36$	$-5.51$	$-4.66$	$-3.81$	$-2.96$	$-2.11$	$-1.26$	$-0.41$	$0.44$	$1.29$
$-19.39$	$-18.52$	$-17.66$	$-16.81$	$-15.96$	$-15.11$	$-14.26$	$-13.41$	$-12.56$	$-11.71$	$-10.86$	$-10.01$	$-9.16$	$-8.31$	$-7.46$	$-6.61$	$-5.76$	$-4.91$	$-4.06$	$-3.21$	$-2.36$	$-1.51$	$-0.66$	$0.19$
$-20.49$	$-19.62$	$-18.76$	$-17.91$	$-17.06$	$-16.21$	$-15.36$	$-14.51$	$-13.66$	$-12.81$	$-11.96$	$-11.11$	$-10.26$	$-9.41$	$-8.56$	$-7.71$	$-6.86$	$-6.01$	$-5.16$	$-4.31$	$-3.46$	$-2.61$	$-1.76$	$-0.91$
$-21.59$	$-20.72$	$-19.86$	$-19.01$	$-18.16$	$-17.31$	$-16.46$	$-15.61$	$-14.76$	$-13.91$	$-13.06$	$-12.21$	$-11.36$	$-10.51$	$-9.66$	$-8.81$	$-7.96$	$-7.11$	$-6.26$	$-5.41$	$-4.56$	$-3.71$	$-2.86$	$-2.01$
$-22.69$	$-21.82$	$-20.96$	$-20.11$	$-19.26$	$-18.41$	$-17.56$	$-16.71$	$-15.86$	$-15.01$	$-14.16$	$-13.31$	$-12.46$	$-11.61$	$-10.76$	$-9.91$	$-9.06$	$-8.21$	$-7.36$	$-6.51$	$-5.66$	$-4.81$	$-3.96$	$-3.11$
$-23.79$	$-22.92$	$-22.06$	$-21.21$	$-20.36$	$-19.51$	$-18.66$	$-17.81$	$-16.96$	$-16.11$	$-15.26$	$-14.41$	$-13.56$	$-12.71$	$-11.86$	$-11.01$	$-10.16$	$-9.31$	$-8.46$	$-7.61$	$-6.76$	$-5.91$	$-5.06$	$-4.21$
$-24.89$	$-24.02$	$-23.16$	$-22.31$	$-21.46$	$-20.61$	$-19.76$	$-18.91$	$-18.06$	$-17.21$	$-16.36$	$-15.51$	$-14.66$	$-13.81$	$-12.96$	$-12.11$	$-11.26$	$-10.41$	$-9.56$	$-8.71$	$-7.86$	$-7.01$	$-6.16$	$-5.31$
$-25.99$	$-25.12$	$-24.26$	$-23.41$	$-22.56$	$-21.71$	$-20.86$	$-20.01$	$-19.16$	$-18.31$	$-17.46$	$-16.61$	$-15.76$	$-14.91$	$-14.06$	$-13.21$	$-12.36$	$-11.51$	$-10.66$	$-9.81$	$-8.96$	$-8.11$	$-7.26$	$-6.41$
$-27.09$	$-26.22$	$-25.36$	$-24.51$	$-23.66$	$-22.81$	$-21.96$	$-21.11$	$-20.26$	$-19.41$	$-18.56$	$-17.71$	$-16.86$	$-16.01$	$-15.16$	$-14.31$	$-13.46$	$-12.61$	$-11.76$	$-10.91$	$-10.06$	$-9.21$	$-8.36$	$-7.51$
$-28.19$	$-27.32$	$-26.46$	$-25.61$	$-24.76$	$-23.91$	$-23.06$	$-22.21$	$-21.36$	$-20.51$	$-19.66$	$-18.81$	$-17.96$	$-17.11$	$-16.26$	$-15.41$	$-14.56$	$-13.71$	$-12.86$	$-12.01$	$-11.16$	$-10.31$	$-9.46$	$-8.61$
$-29.29$	$-28.42$	$-27.56$	$-26.71$	$-25.86$	$-25.01$	$-24.16$	$-23.31$	$-22.46$	$-21.61$	$-20.76$	$-19.91$	$-19.06$	$-18.21$	$-17.36$	$-16.51$	$-15.66$	$-14.81$	$-13.96$	$-13.11$	$-12.26$	$-11.41$	$-10.56$	$-9.71$
$-30.39$	$-29.52$	$-28.66$	$-27.81$	$-26.96$	$-26.11$	$-25.26$	$-24.41$	$-23.56$	$-22.71$	$-21.86$	$-21.01$	$-20.16$	$-19.31$	$-18.46$	$-17.61$	$-16.76$	$-15.91$	$-15.06$	$-14.21$	$-13.36$	$-12.51$	$-11.66$	$-10.81$

TABLE (17) epoch 1550 Inclination  $i_r$  according to theory. Values without sign are positive. Degrees in mins. are separated by dots.

$\lambda = 0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$	
84.19	85.16	86.13	87.10	88.07	89.04	90.01	90.98	91.95	92.92	93.89	94.86	95.83	96.80	97.77	98.74	99.71	100.68	101.65	102.62	103.59	104.56	105.53	106.50	107.47
81.0	82.00	83.00	84.00	85.00	86.00	87.00	88.00	89.00	90.00	91.00	92.00	93.00	94.00	95.00	96.00	97.00	98.00	99.00	100.00	101.00	102.00	103.00	104.00	105.00
76.19	77.18	78.16	79.16	80.15	81.14	82.13	83.12	84.11	85.10	86.09	87.08	88.07	89.06	90.05	91.04	92.03	93.02	94.01	95.00	96.00	97.00	98.00	99.00	100.00
70.39	71.38	72.37	73.36	74.35	75.34	76.33	77.32	78.31	79.30	80.29	81.28	82.27	83.26	84.25	85.24	86.23	87.22	88.21	89.20	90.19	91.18	92.17	93.16	94.15
63.15	64.14	65.13	66.12	67.11	68.10	69.09	70.08	71.07	72.06	73.05	74.04	75.03	76.02	77.01	78.00	79.00	80.00	81.00	82.00	83.00	84.00	85.00	86.00	87.00
51.58	52.57	53.56	54.55	55.54	56.53	57.52	58.51	59.50	60.49	61.48	62.47	63.46	64.45	65.44	66.43	67.42	68.41	69.40	70.39	71.38	72.37	73.36	74.35	75.34
42.35	43.34	44.33	45.32	46.31	47.30	48.29	49.28	50.27	51.26	52.25	53.24	54.23	55.22	56.21	57.20	58.19	59.18	60.17	61.16	62.15	63.14	64.13	65.12	66.11
38.44	39.43	40.42	41.41	42.40	43.39	44.38	45.37	46.36	47.35	48.34	49.33	50.32	51.31	52.30	53.29	54.28	55.27	56.26	57.25	58.24	59.23	60.22	61.21	62.20
31.34	32.33	33.32	34.31	35.30	36.29	37.28	38.27	39.26	40.25	41.24	42.23	43.22	44.21	45.20	46.19	47.18	48.17	49.16	50.15	51.14	52.13	53.12	54.11	55.10
21.15	22.14	23.13	24.12	25.11	26.10	27.09	28.08	29.07	30.06	31.05	32.04	33.03	34.02	35.01	36.00	37.00	38.00	39.00	40.00	41.00	42.00	43.00	44.00	45.00
11.15	12.14	13.13	14.12	15.11	16.10	17.09	18.08	19.07	20.06	21.05	22.04	23.03	24.02	25.01	26.00	27.00	28.00	29.00	30.00	31.00	32.00	33.00	34.00	35.00
1.15	2.14	3.13	4.12	5.11	6.10	7.09	8.08	9.07	10.06	11.05	12.04	13.03	14.02	15.01	16.00	17.00	18.00	19.00	20.00	21.00	22.00	23.00	24.00	25.00



Table (18) epoch 1550. Horizontal intensity  $I_h$  according to theory. For  $\phi = +90^\circ = 90^\circ$ ,  $\lambda = 0^\circ$ ,  $\lambda = 90^\circ$ ,  $\lambda = 180^\circ$ ,  $\lambda = 270^\circ$ ,  $\lambda = 360^\circ$ .

$\phi = 0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$	$360^\circ$
+80	0.725	0.477	0.435	0.427	0.450	0.525	0.603	0.674	0.722	0.741	0.728	0.686	0.628	0.566	0.503	0.442	0.385	0.335	0.293	0.258	0.230	0.207	0.188	0.172
+70	0.833	0.740	0.625	0.600	0.630	0.840	1.034	1.181	1.281	1.330	1.319	1.233	1.149	1.065	0.983	0.903	0.825	0.750	0.678	0.610	0.548	0.491	0.439	0.390
+60	1.133	1.109	0.977	0.902	1.111	1.363	1.594	1.762	1.865	1.912	1.901	1.824	1.679	1.553	1.443	1.347	1.265	1.196	1.139	1.084	1.031	0.980	0.930	0.881
+50	1.671	1.579	1.479	1.408	1.708	2.012	2.346	2.628	2.855	2.992	2.977	2.807	2.567	2.353	2.165	1.992	1.834	1.691	1.561	1.443	1.336	1.231	1.128	1.026
+40	2.110	2.070	2.012	2.077	2.352	2.685	3.062	3.482	3.942	4.440	4.974	5.542	6.143	6.775	7.437	8.128	8.848	9.596	10.371	11.172	11.998	12.848	13.721	14.616
+30	2.443	2.480	2.472	2.522	2.916	3.332	3.782	4.264	4.776	5.316	5.884	6.478	7.106	7.766	8.457	9.178	9.928	10.706	11.512	12.345	13.204	14.088	14.996	15.928
+20	2.745	2.749	2.705	2.757	3.232	3.732	4.262	4.820	5.404	5.992	6.594	7.218	7.862	8.526	9.208	9.908	10.624	11.356	12.102	12.862	13.636	14.424	15.226	16.042
+10	2.977	2.974	2.941	3.125	3.528	3.959	4.416	4.896	5.396	5.914	6.450	7.004	7.576	8.164	8.766	9.382	10.012	10.654	11.308	11.974	12.652	13.342	14.044	14.758
0	2.917	2.900	2.921	3.125	3.528	3.959	4.416	4.896	5.396	5.914	6.450	7.004	7.576	8.164	8.766	9.382	10.012	10.654	11.308	11.974	12.652	13.342	14.044	14.758
-10	2.893	2.858	2.920	3.018	3.458	3.879	4.281	4.653	5.004	5.332	5.636	5.914	6.166	6.392	6.592	6.766	6.914	7.036	7.132	7.202	7.246	7.264	7.256	7.228
-20	2.827	2.790	2.787	2.809	3.261	3.693	4.104	4.484	4.832	5.148	5.432	5.684	5.904	6.092	6.248	6.372	6.464	6.524	6.552	6.548	6.512	6.444	6.344	6.212
-30	2.728	2.677	2.654	2.651	3.115	3.546	3.956	4.344	4.708	5.046	5.356	5.636	5.884	6.100	6.284	6.436	6.556	6.644	6.692	6.700	6.664	6.584	6.464	6.304
-40	2.604	2.547	2.522	2.504	2.966	3.396	3.806	4.194	4.558	4.896	5.206	5.486	5.732	5.944	6.120	6.264	6.376	6.456	6.492	6.484	6.432	6.332	6.184	6.004
-50	2.454	2.442	2.418	2.382	2.842	3.272	3.682	4.070	4.434	4.772	5.082	5.362	5.612	5.832	6.020	6.176	6.292	6.368	6.404	6.396	6.324	6.192	6.012	5.792
-60	2.315	2.279	2.266	2.232	2.692	3.122	3.532	3.920	4.284	4.622	4.932	5.212	5.462	5.682	5.870	6.026	6.142	6.218	6.254	6.246	6.154	5.992	5.772	5.512
-70	2.185	2.138	2.125	2.091	2.551	2.981	3.391	3.779	4.143	4.481	4.801	5.091	5.341	5.561	5.749	5.905	6.021	6.097	6.133	6.125	6.012	5.812	5.552	5.252
-80	2.065	2.018	2.005	1.971	2.431	2.861	3.271	3.659	4.023	4.361	4.681	4.971	5.221	5.441	5.629	5.785	5.901	5.977	5.999	5.961	5.824	5.584	5.284	4.944

Table (19) epoch 1550 Total intensity  $I_t$  according to theory. For  $\phi = +90^\circ = 90^\circ$ ,  $\lambda = 0^\circ$ ,  $\lambda = 90^\circ$ ,  $\lambda = 180^\circ$ ,  $\lambda = 270^\circ$ ,  $\lambda = 360^\circ$ .

$\phi = 0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$	$360^\circ$
+80	5.634	5.647	5.673	5.659	5.721	5.737	5.752	5.769	5.792	5.818	5.848	5.882	5.920	5.962	6.008	6.058	6.112	6.170	6.232	6.298	6.368	6.442	6.520	6.602
+70	5.451	5.542	5.643	5.716	5.749	5.736	5.695	5.653	5.634	5.640	5.673	5.723	5.783	5.853	5.933	6.023	6.123	6.233	6.353	6.483	6.623	6.773	6.933	7.103
+60	5.278	5.469	5.660	5.776	5.794	5.715	5.582	5.443	5.351	5.330	5.401	5.543	5.706	5.893	6.103	6.333	6.583	6.853	7.143	7.453	7.783	8.133	8.503	8.893
+50	5.042	5.299	5.555	5.711	5.703	5.544	5.316	5.098	4.917	4.869	4.955	5.116	5.306	5.523	5.763	6.023	6.303	6.603	6.923	7.263	7.623	8.003	8.403	8.823
+40	4.829	5.060	5.283	5.428	5.384	5.157	4.870	4.620	4.512	4.560	4.738	4.950	5.193	5.463	5.753	6.063	6.393	6.743	7.113	7.503	7.913	8.343	8.793	9.263
+30	4.623	4.870	5.072	5.194	5.094	4.844	4.596	4.307	4.085	3.929	3.844	4.035	4.260	4.513	4.783	5.063	5.353	5.663	6.003	6.363	6.743	7.143	7.563	8.003
+20	4.423	4.707	4.907	4.931	4.741	4.507	4.249	3.973	3.703	3.543	3.473	3.696	3.943	4.213	4.503	4.803	5.123	5.463	5.823	6.203	6.603	7.023	7.463	7.923
+10	4.266	4.588	4.787	4.811	4.621	4.387	4.129	3.853	3.583	3.423	3.353	3.576	3.823	4.093	4.383	4.693	5.023	5.373	5.743	6.133	6.543	6.973	7.423	7.893
0	4.270	4.590	4.787	4.811	4.621	4.387	4.129	3.853	3.583	3.423	3.353	3.576	3.823	4.093	4.383	4.693	5.023	5.373	5.743	6.133	6.543	6.973	7.423	7.893
-10	4.270	4.590	4.787	4.811	4.621	4.387	4.129	3.853	3.583	3.423	3.353	3.576	3.823	4.093	4.383	4.693	5.023	5.373	5.743	6.133	6.543	6.973	7.423	7.893
-20	4.266	4.588	4.787	4.811	4.621	4.387	4.129	3.853	3.583	3.423	3.353	3.576	3.823	4.093	4.383	4.693	5.023	5.373	5.743	6.133	6.543	6.973	7.423	7.893
-30	4.270	4.590	4.787	4.811	4.621	4.387	4.129	3.853	3.583	3.423	3.353	3.576	3.823	4.093	4.383	4.693	5.023	5.373	5.743	6.133	6.543	6.973	7.423	7.893
-40	4.266	4.588	4.787	4.811	4.621	4.387	4.129	3.853	3.583	3.423	3.353	3.576	3.823	4.093	4.383	4.693	5.023	5.373	5.743	6.133	6.543	6.973	7.423	7.893
-50	4.270	4.590	4.787	4.811	4.621	4.387	4.129	3.853	3.583	3.423	3.353	3.576	3.823	4.093	4.383	4.693	5.023	5.373	5.743	6.133	6.543	6.973	7.423	7.893
-60	4.266	4.588	4.787	4.811	4.621	4.387	4.129	3.853	3.583	3.423	3.353	3.576	3.823	4.093	4.383	4.693	5.023	5.373	5.743	6.133	6.543	6.973	7.423	7.893
-70	4.270	4.590	4.787	4.811	4.621	4.387	4.129	3.853	3.583	3.423	3.353	3.576	3.823	4.093	4.383	4.693	5.023	5.373	5.743	6.133	6.543	6.973	7.423	7.893
-80	4.266	4.588	4.787	4.811	4.621	4.387	4.129	3.853	3.583	3.423	3.353	3.576	3.823	4.093	4.383	4.693	5.023	5.373	5.743	6.133	6.543	6.973	7.423	7.893

The following tables (21), (22), (23) were used as a basis for calculating the coefficients of the theory for epoch 1900. Table (21) declination  $\delta$ . Epoch 1900.

$\lambda = 0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$
+0	+22.2	+12.4	+0.0	-12.4	-22.2	-32.2	-42.2	-52.2	-62.2	-72.2	-82.2	-92.2	-102.2	-112.2	-122.2	-132.2	-142.2	-152.2	-162.2	-172.2	-182.2	-192.2	-202.2
+10	+22.1	+12.3	+0.0	-12.3	-22.1	-32.1	-42.1	-52.1	-62.1	-72.1	-82.1	-92.1	-102.1	-112.1	-122.1	-132.1	-142.1	-152.1	-162.1	-172.1	-182.1	-192.1	-202.1
+20	+22.0	+12.2	+0.0	-12.2	-22.0	-32.0	-42.0	-52.0	-62.0	-72.0	-82.0	-92.0	-102.0	-112.0	-122.0	-132.0	-142.0	-152.0	-162.0	-172.0	-182.0	-192.0	-202.0
+30	+21.9	+12.1	+0.0	-12.1	-21.9	-31.9	-41.9	-51.9	-61.9	-71.9	-81.9	-91.9	-101.9	-111.9	-121.9	-131.9	-141.9	-151.9	-161.9	-171.9	-181.9	-191.9	-201.9
+40	+21.8	+12.0	+0.0	-12.0	-21.8	-31.8	-41.8	-51.8	-61.8	-71.8	-81.8	-91.8	-101.8	-111.8	-121.8	-131.8	-141.8	-151.8	-161.8	-171.8	-181.8	-191.8	-201.8
+50	+21.7	+11.9	+0.0	-11.9	-21.7	-31.7	-41.7	-51.7	-61.7	-71.7	-81.7	-91.7	-101.7	-111.7	-121.7	-131.7	-141.7	-151.7	-161.7	-171.7	-181.7	-191.7	-201.7
+60	+21.6	+11.8	+0.0	-11.8	-21.6	-31.6	-41.6	-51.6	-61.6	-71.6	-81.6	-91.6	-101.6	-111.6	-121.6	-131.6	-141.6	-151.6	-161.6	-171.6	-181.6	-191.6	-201.6
+70	+21.5	+11.7	+0.0	-11.7	-21.5	-31.5	-41.5	-51.5	-61.5	-71.5	-81.5	-91.5	-101.5	-111.5	-121.5	-131.5	-141.5	-151.5	-161.5	-171.5	-181.5	-191.5	-201.5
+80	+21.4	+11.6	+0.0	-11.6	-21.4	-31.4	-41.4	-51.4	-61.4	-71.4	-81.4	-91.4	-101.4	-111.4	-121.4	-131.4	-141.4	-151.4	-161.4	-171.4	-181.4	-191.4	-201.4
+90	+21.3	+11.5	+0.0	-11.5	-21.3	-31.3	-41.3	-51.3	-61.3	-71.3	-81.3	-91.3	-101.3	-111.3	-121.3	-131.3	-141.3	-151.3	-161.3	-171.3	-181.3	-191.3	-201.3
+100	+21.2	+11.4	+0.0	-11.4	-21.2	-31.2	-41.2	-51.2	-61.2	-71.2	-81.2	-91.2	-101.2	-111.2	-121.2	-131.2	-141.2	-151.2	-161.2	-171.2	-181.2	-191.2	-201.2
+110	+21.1	+11.3	+0.0	-11.3	-21.1	-31.1	-41.1	-51.1	-61.1	-71.1	-81.1	-91.1	-101.1	-111.1	-121.1	-131.1	-141.1	-151.1	-161.1	-171.1	-181.1	-191.1	-201.1
+120	+21.0	+11.2	+0.0	-11.2	-21.0	-31.0	-41.0	-51.0	-61.0	-71.0	-81.0	-91.0	-101.0	-111.0	-121.0	-131.0	-141.0	-151.0	-161.0	-171.0	-181.0	-191.0	-201.0
+130	+20.9	+11.1	+0.0	-11.1	-20.9	-30.9	-40.9	-50.9	-60.9	-70.9	-80.9	-90.9	-100.9	-110.9	-120.9	-130.9	-140.9	-150.9	-160.9	-170.9	-180.9	-190.9	-200.9
+140	+20.8	+11.0	+0.0	-11.0	-20.8	-30.8	-40.8	-50.8	-60.8	-70.8	-80.8	-90.8	-100.8	-110.8	-120.8	-130.8	-140.8	-150.8	-160.8	-170.8	-180.8	-190.8	-200.8
+150	+20.7	+10.9	+0.0	-10.9	-20.7	-30.7	-40.7	-50.7	-60.7	-70.7	-80.7	-90.7	-100.7	-110.7	-120.7	-130.7	-140.7	-150.7	-160.7	-170.7	-180.7	-190.7	-200.7
+160	+20.6	+10.8	+0.0	-10.8	-20.6	-30.6	-40.6	-50.6	-60.6	-70.6	-80.6	-90.6	-100.6	-110.6	-120.6	-130.6	-140.6	-150.6	-160.6	-170.6	-180.6	-190.6	-200.6
+170	+20.5	+10.7	+0.0	-10.7	-20.5	-30.5	-40.5	-50.5	-60.5	-70.5	-80.5	-90.5	-100.5	-110.5	-120.5	-130.5	-140.5	-150.5	-160.5	-170.5	-180.5	-190.5	-200.5
+180	+20.4	+10.6	+0.0	-10.6	-20.4	-30.4	-40.4	-50.4	-60.4	-70.4	-80.4	-90.4	-100.4	-110.4	-120.4	-130.4	-140.4	-150.4	-160.4	-170.4	-180.4	-190.4	-200.4
+190	+20.3	+10.5	+0.0	-10.5	-20.3	-30.3	-40.3	-50.3	-60.3	-70.3	-80.3	-90.3	-100.3	-110.3	-120.3	-130.3	-140.3	-150.3	-160.3	-170.3	-180.3	-190.3	-200.3
+200	+20.2	+10.4	+0.0	-10.4	-20.2	-30.2	-40.2	-50.2	-60.2	-70.2	-80.2	-90.2	-100.2	-110.2	-120.2	-130.2	-140.2	-150.2	-160.2	-170.2	-180.2	-190.2	-200.2

Table (21) Declination  $\delta$ . Epoch 1900. Interpolation  $\delta$ .

$\lambda = 0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$
+0	+22.2	+12.4	+0.0	-12.4	-22.2	-32.2	-42.2	-52.2	-62.2	-72.2	-82.2	-92.2	-102.2	-112.2	-122.2	-132.2	-142.2	-152.2	-162.2	-172.2	-182.2	-192.2	-202.2
+10	+22.1	+12.3	+0.0	-12.3	-22.1	-32.1	-42.1	-52.1	-62.1	-72.1	-82.1	-92.1	-102.1	-112.1	-122.1	-132.1	-142.1	-152.1	-162.1	-172.1	-182.1	-192.1	-202.1
+20	+22.0	+12.2	+0.0	-12.2	-22.0	-32.0	-42.0	-52.0	-62.0	-72.0	-82.0	-92.0	-102.0	-112.0	-122.0	-132.0	-142.0	-152.0	-162.0	-172.0	-182.0	-192.0	-202.0
+30	+21.9	+12.1	+0.0	-12.1	-21.9	-31.9	-41.9	-51.9	-61.9	-71.9	-81.9	-91.9	-101.9	-111.9	-121.9	-131.9	-141.9	-151.9	-161.9	-171.9	-181.9	-191.9	-201.9
+40	+21.8	+12.0	+0.0	-12.0	-21.8	-31.8	-41.8	-51.8	-61.8	-71.8	-81.8	-91.8	-101.8	-111.8	-121.8	-131.8	-141.8	-151.8	-161.8	-171.8	-181.8	-191.8	-201.8
+50	+21.7	+11.9	+0.0	-11.9	-21.7	-31.7	-41.7	-51.7	-61.7	-71.7	-81.7	-91.7	-101.7	-111.7	-121.7	-131.7	-141.7	-151.7	-161.7	-171.7	-181.7	-191.7	-201.7
+60	+21.6	+11.8	+0.0	-11.8	-21.6	-31.6	-41.6	-51.6	-61.6	-71.6	-81.6	-91.6	-101.6	-111.6	-121.6	-131.6	-141.6	-151.6	-161.6	-171.6	-181.6	-191.6	-201.6
+70	+21.5	+11.7	+0.0	-11.7	-21.5	-31.5	-41.5	-51.5	-61.5	-71.5	-81.5	-91.5	-101.5	-111.5	-121.5	-131.5	-141.5	-151.5	-161.5	-171.5	-181.5	-191.5	-201.5
+80	+21.4	+11.6	+0.0	-11.6	-21.4	-31.4	-41.4	-51.4	-61.4	-71.4	-81.4	-91.4	-101.4	-111.4	-121.4	-131.4	-141.4	-151.4	-161.4	-171.4	-181.4	-191.4	-201.4
+90	+21.3	+11.5	+0.0	-11.5	-21.3	-31.3	-41.3	-51.3	-61.3	-71.3	-81.3	-91.3	-101.3	-111.3	-121.3	-131.3	-141.3	-151.3	-161.3	-171.3	-181.3	-191.3	-201.3
+100	+21.2	+11.4	+0.0	-11.4	-21.2	-31.2	-41.2	-51.2	-61.2	-71.2	-81.2	-91.2	-101.2	-111.2	-121.2	-131.2	-141.2	-151.2	-161.2	-171.2	-181.2	-191.2	-201.2
+110	+21.1	+11.3	+0.0	-11.3	-21.1	-31.1	-41.1	-51.1	-61.1	-71.1	-81.1	-91.1	-101.1	-111.1	-121.1	-131.1	-141.1	-151.1	-161.1	-171.1	-181.1	-191.1	-201.1
+120	+21.0	+11.2	+0.0	-11.2	-21.0	-31.0	-41.0	-51.0	-61.0	-71.0	-81.0	-91.0	-101.0	-111.0	-121.0	-131.0	-141.0	-151.0	-161.0	-171.0	-181.0	-191.0	-201.0
+130	+20.9	+11.1	+0.0	-11.1	-20.9	-30.9	-40.9	-50.9	-60.9	-70.9	-80.9	-90.9	-100.9	-110.9	-120.9	-130.9	-140.9	-150.9	-160.9	-170.9	-180.9	-190.9	-200.9
+140	+20.8	+11.0	+0.0	-11.0	-20.8	-30.8	-40.8	-50.8	-60.8	-70.8	-80.8	-90.8	-100.8	-110.8	-120.8	-130.8	-140.8	-150.8	-160.8	-170.8	-180.8	-190.8	-200.8
+150	+20.7	+10.9	+0.0	-10.9	-20.7	-30.7	-40.7	-50.7	-60.7	-70.7	-80.7	-90.7	-100.7	-110.7	-120.7	-130.7	-140.7	-150.7	-160.7	-170.7	-180.7	-190.7	-200.7
+160	+20.6	+10.8	+0.0	-10.8	-20.6	-30.6	-40.6	-50.6	-60.6	-70.6	-80.6	-90.6	-100.6	-110.6	-120.6	-130.6	-140.6	-150.6	-160.6	-170.6	-180.6	-190.6	-200.6
+170	+20.5	+10.7	+0.0	-10.7	-20.5	-30.5	-40.5	-50.5	-60.5	-70.5	-80.5	-90.5	-100.5	-110.5	-120.5	-130.5	-140.5	-150.5	-160.5	-170.5	-180.5	-190.5	-200.5
+180	+20.4	+10.6	+0.0	-10.6	-20.4	-30.4	-40.4	-50.4	-60.4	-70.4	-80.4	-90.4	-100.4	-110.4	-120.4	-130.4	-140.4	-150.4	-160.4	-170.4	-180.4	-190.4	-200.4
+190	+20.3	+10.5	+0.0	-10.5	-20.3	-30.3	-40.3	-50.3	-60.3	-70.3	-80.3	-90.3	-100.3	-110.3	-120.3	-130.3	-140.3	-150.3	-160.3	-170.3	-180.3	-190.3	-200.3
+200	+20.2	+10.4	+0.0	-10.4	-20.2	-30.2	-40.2	-50.2	-60.2	-70.2	-80.2	-90.2	-100.2	-110.2	-120.2	-130.2	-140.2	-150.2	-160.2	-170.2	-180.2	-190.2	-200.2

TABLE 23. Spect. 1900. Horizontal intensity  $I_h$ .

$\lambda$	0°	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°	195°	210°	225°	240°	255°	270°	285°	300°	315°	330°	345°
+80°	0.81	0.83	0.79	0.74	0.65	0.61	0.52	0.45	0.44	0.42	0.44	0.43	0.41	0.38	0.32	0.23	0.25	0.26	0.26	0.25	0.24	0.23	0.22	0.21
+70°	1.17	1.18	1.17	1.11	1.04	0.96	0.84	0.78	0.79	0.81	0.84	1.10	1.13	1.07	0.92	0.73	0.49	0.17	0.14	0.49	0.71	0.84	1.06	0.98
+60°	1.42	1.28	1.63	1.62	1.55	1.48	1.40	1.38	1.45	1.64	1.70	1.75	1.77	1.66	1.50	1.34	1.06	0.71	0.42	0.61	0.90	1.15	1.30	1.48
+50°	1.90	1.77	2.05	2.13	2.16	2.14	2.08	2.17	2.22	2.30	2.31	2.34	2.33	2.15	2.05	1.88	1.68	1.40	1.13	1.14	1.35	1.57	1.62	1.73
+40°	2.36	2.27	2.57	2.65	2.72	2.79	2.80	2.78	2.81	2.82	2.78	2.68	2.57	2.49	2.49	2.48	2.38	2.23	2.01	1.91	1.93	1.33	2.11	2.74
+30°	2.71	2.87	3.02	3.19	3.34	3.43	3.45	3.41	3.33	3.20	3.07	2.96	2.84	2.80	2.82	2.91	2.91	2.88	2.80	2.58	2.43	2.31	2.35	2.53
+20°	2.99	3.12	3.29	3.45	3.62	3.70	3.82	3.72	3.68	3.48	3.33	3.16	3.10	3.07	3.14	3.22	3.34	3.37	3.29	3.12	2.90	2.74	2.79	2.82
+10°	3.20	3.23	3.31	3.43	3.55	3.61	3.86	3.93	3.82	3.71	3.58	3.44	3.40	3.38	3.41	3.43	3.58	3.62	3.56	3.30	3.02	2.93	2.97	3.07
0	2.95	3.05	3.04	3.17	3.33	3.52	3.71	3.83	3.88	3.83	3.75	3.66	3.60	3.55	3.51	3.49	3.53	3.55	3.47	3.26	2.99	2.93	2.92	2.94
-10°	2.62	2.58	2.62	2.74	2.92	3.16	3.40	3.61	3.72	3.75	3.71	3.65	3.62	3.55	3.46	3.37	3.36	3.35	3.28	3.04	2.81	2.72	2.68	2.66
-20°	2.29	2.24	2.24	2.32	2.42	2.65	2.85	3.10	3.30	3.43	3.46	3.45	3.41	3.36	3.28	3.17	3.13	3.11	3.02	2.81	2.64	2.52	2.45	2.40
-30°	2.12	1.96	1.99	1.97	2.03	2.17	2.31	2.47	2.66	2.82	2.84	2.77	3.03	3.03	2.98	2.93	2.89	2.85	2.82	2.74	2.56	2.43	2.32	2.23
-40°	2.03	1.89	1.81	1.75	1.72	1.76	1.84	1.91	1.97	2.05	2.23	2.37	2.49	2.42	2.65	2.66	2.66	2.72	2.79	2.80	2.61	2.50	2.32	2.18
-50°	2.02	1.84	1.71	1.63	1.56	1.52	1.57	1.40	1.31	1.32	1.32	1.74	1.99	2.16	2.25	2.31	2.41	2.60	2.75	2.85	2.79	2.62	2.43	2.23
-60°	2.09	1.88	1.73	1.55	1.43	1.32	1.18	0.97	0.78	0.73	0.88	1.14	1.39	1.60	1.79	1.93	2.14	2.34	2.60	2.76	2.76	2.63	2.48	2.29
-70°	2.03	1.87	1.73	1.60	1.45	1.31	1.13	0.89	0.60	0.30	0.29	0.49	0.71	0.92	1.14	1.39	1.64	1.94	2.18	2.31	2.37	2.40	2.34	2.19
-80°	1.76	1.69	1.59	1.49	1.37	1.22	1.08	0.91	0.73	0.56	0.44	0.38	0.44	0.60	0.84	1.03	1.26	1.45	1.61	1.77	1.85	1.86	1.87	1.85

The values ~~without~~ without a star are the sum of the elements /16  
of the magnetic maps for 1885 (see Publication I (pages 3-6)  
and the secular changes of our tables (46), (47), (48) Chapter II  
given below, multiplied by 15. The values which have a star on  
the right in (21), (22) and (23) are obtained using observations,  
which were made on the average four years before the epoch 1900 at  
68 different locations. They are contained in the following docu-  
ments.

1) G. W. Littlehales, the secular change in the direction of  
the terrestrial magnetic field, Washington, 1899.

2) C. Chree, report of the Kiev Observatory, committee for  
the year 1898, page 30-31.

3) Earth magnetic observations of the officers of the kaiser  
Austrian Navy ships, Zrini and Aurora, 1895-1898.

4) G. R. Putnan, report A magnetic pendulum observations  
made, 1896.

5) Meteorological publication, February 1894, page 76, August  
1895, pages 297 and 298, May 1894, page 40, March 1893, page 22,  
July 1896, page 52, OCTBER. 1894, page 394.

6) Magazine Terrestrial Magnetism April 1896, page 85 and  
March 1899, page 62.

7) H. Fritsche, Magnetic observations at 509 locations made  
in Europe between 1867-1894, pages 16-17, locations no. 126-130.  
The reduction of these measurements to the epoch 1900 was done  
using Tables (46), (47), (48) Chapter II. For the adjacent inter-  
sections of the meridians and the parallels, they were done using  
the tables given in Publication I pages 42-53, Tables 27, 28, 29.  
The values of the coefficients  $g_h$  of the theory resulting from  
(21), (22) and (23) are found in Chapter I. The sine and cosines

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series for  $X_r, Y_r, Z_r$  as well as the quantities  $X_r, Y_r, Z_r, \delta, \epsilon, \tau$  and  $J_r$  which results from them are given in the following tables (24), (25), (26), (27), (28), (29), (30), (31), (32) and (33).

/17

TABLE (24). Epoch 1900.

$u$	$K_0$	$K_1$	$K_2$	$K_3$	$K_4$	$K_5$	$K_6$	$K_7$	$K_8$	$K_9$
	$\cos \lambda$	$\sin \lambda$	$\cos 2\lambda$	$\sin 2\lambda$	$\cos 3\lambda$	$\sin 3\lambda$	$\cos 4\lambda$	$\sin 4\lambda$	$\cos 5\lambda$	$\sin 5\lambda$
10°	$X_r = +0.311 + 0.204 + 0.359 + 0.205 + 0.034 - 0.008 - 0.005 + 0.000 - 0.001 + 0.000 + 0.000$									
20°	$X_r = +0.699 + 0.025 + 0.400 + 0.327 + 0.057 - 0.023 - 0.010 - 0.003 - 0.009 + 0.000 + 0.001$									
30°	$X_r = +1.194 - 0.141 + 0.451 + 0.319 + 0.072 - 0.018 - 0.003 - 0.006 - 0.012 + 0.003 + 0.005$									
40°	$X_r = +1.770 - 0.207 + 0.480 + 0.192 + 0.093 + 0.012 + 0.022 - 0.005 - 0.025 + 0.005 + 0.011$									
50°	$X_r = +2.351 - 0.169 + 0.460 + 0.002 + 0.127 + 0.057 + 0.054 + 0.002 - 0.020 + 0.009 + 0.015$									
60°	$X_r = +2.851 - 0.109 + 0.394 - 0.169 + 0.154 + 0.072 + 0.076 + 0.015 - 0.003 + 0.009 + 0.011$									
70°	$X_r = +3.207 - 0.114 + 0.311 - 0.263 + 0.149 + 0.070 - 0.074 + 0.025 + 0.012 + 0.007 + 0.002$									
80°	$X_r = +3.375 - 0.228 + 0.246 - 0.269 + 0.091 + 0.046 + 0.056 + 0.025 + 0.018 + 0.003 - 0.011$									
90°	$X_r = +3.340 - 0.404 + 0.205 - 0.213 + 0.002 + 0.022 + 0.033 + 0.014 + 0.013 - 0.003 - 0.019$									
100°	$X_r = +3.127 - 0.556 + 0.144 - 0.139 - 0.081 + 0.028 + 0.014 - 0.001 + 0.002 - 0.007 - 0.019$									
110°	$X_r = +2.799 - 0.602 + 0.001 - 0.083 - 0.123 + 0.030 - 0.004 - 0.015 - 0.004 - 0.009 - 0.010$									
120°	$X_r = +2.443 - 0.507 - 0.248 - 0.047 - 0.122 + 0.002 - 0.028 - 0.019 - 0.001 - 0.007 - 0.001$									
130°	$X_r = +2.131 - 0.275 - 0.542 - 0.020 - 0.103 - 0.038 - 0.058 - 0.016 + 0.006 - 0.005 + 0.005$									
140°	$X_r = +1.866 + 0.059 - 0.752 + 0.010 - 0.093 - 0.034 - 0.020 - 0.009 + 0.011 - 0.003 + 0.005$									
150°	$X_r = +1.588 + 0.441 - 0.785 + 0.039 - 0.098 - 0.096 - 0.077 - 0.004 + 0.010 - 0.001 + 0.003$									
160°	$X_r = +1.199 + 0.801 - 0.648 + 0.053 - 0.095 - 0.067 - 0.050 - 0.001 + 0.005 + 0.000 + 0.001$									
170°	$X_r = +0.655 + 1.064 - 0.463 + 0.039 - 0.060 - 0.022 - 0.015 + 0.000 + 0.001 + 0.000 + 0.000$									

TABLE (25). Epoch 1900.

$u$	$L_1$	$L_2$	$L_3$	$L_4$	$L_5$	$L_6$	$L_7$	$L_8$	$L_9$
	$\cos \lambda$	$\sin \lambda$	$\cos 2\lambda$	$\sin 2\lambda$	$\cos 3\lambda$	$\sin 3\lambda$	$\cos 4\lambda$	$\sin 4\lambda$	$\cos 5\lambda$
10°	$Y_r = +0.351 - 0.255 + 0.035 - 0.213 - 0.004 + 0.009 - 0.001 + 0.000 + 0.000 + 0.000$								
20°	$Y_r = +0.373 - 0.190 + 0.066 - 0.389 - 0.013 + 0.029 - 0.009 + 0.004 + 0.001 + 0.000$								
30°	$Y_r = +0.404 - 0.107 + 0.090 - 0.498 - 0.018 + 0.045 - 0.025 + 0.009 + 0.006 - 0.003$								
40°	$Y_r = +0.441 - 0.033 + 0.115 - 0.530 - 0.007 - 0.039 - 0.013 + 0.014 + 0.016 - 0.007$								
50°	$Y_r = +0.477 + 0.015 + 0.146 - 0.440 + 0.020 + 0.009 - 0.059 + 0.014 + 0.028 - 0.013$								
60°	$Y_r = +0.509 + 0.042 + 0.185 - 0.299 + 0.057 - 0.033 - 0.041 + 0.005 + 0.039 - 0.021$								
70°	$Y_r = +0.536 + 0.058 + 0.231 - 0.225 + 0.095 - 0.073 - 0.052 - 0.010 + 0.043 - 0.027$								
80°	$Y_r = +0.559 + 0.084 + 0.262 - 0.174 + 0.126 - 0.100 - 0.038 - 0.028 + 0.036 - 0.030$								
90°	$Y_r = +0.587 + 0.138 + 0.276 - 0.086 + 0.148 - 0.117 - 0.024 - 0.021 + 0.022 - 0.030$								
100°	$Y_r = +0.631 + 0.226 + 0.266 - 0.026 + 0.162 - 0.134 - 0.020 - 0.046 + 0.004 - 0.026$								
110°	$Y_r = +0.676 - 0.346 + 0.239 + 0.015 + 0.173 - 0.157 - 0.022 - 0.042 - 0.009 - 0.019$								
120°	$Y_r = +0.711 + 0.490 + 0.209 + 0.039 + 0.179 - 0.183 - 0.027 - 0.033 - 0.015 - 0.013$								
130°	$Y_r = +0.713 + 0.645 + 0.184 + 0.062 + 0.172 - 0.199 - 0.029 - 0.020 - 0.014 - 0.007$								
140°	$Y_r = +0.671 + 0.799 + 0.167 + 0.076 + 0.149 - 0.187 - 0.023 - 0.010 - 0.010 - 0.003$								
150°	$Y_r = +0.588 + 0.941 + 0.148 + 0.080 + 0.106 - 0.143 - 0.013 - 0.003 - 0.004 - 0.001$								
160°	$Y_r = +0.489 + 1.058 + 0.114 + 0.069 + 0.057 - 0.079 - 0.005 + 0.000 - 0.001 - 0.000$								
170°	$Y_r = +0.409 + 1.133 + 0.065 + 0.034 + 0.016 - 0.023 - 0.001 + 0.000 + 0.000 + 0.000$								





TABLE (27) epoch 1900. Northern component  $X_r$  according to theory. For  $\phi = +90$  we have  $X_r = \lambda + 18^\circ 2'$ ,  $Y_r = 1819 \cos \delta$ ,  $Y_r = 1819$ . The values of  $X_r$  without sine are positive.

$\phi$	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°	195°	210°	225°	240°	255°	270°	285°	300°	315°	330°	345°
+90	0.881	0.360	0.415	0.448	0.438	0.405	0.344	0.260	0.157	0.045	-0.078	-0.182	-0.281	-0.365	-0.431	-0.478	-0.505	-0.513	-0.500	-0.467	-0.415	-0.345	-0.258
+80	0.712	0.785	0.793	0.745	0.660	0.561	0.470	0.407	0.380	0.377	0.383	0.371	0.350	0.323	0.293	0.259	0.225	0.190	0.155	0.120	0.085	0.050	0.015
+70	1.015	1.107	1.116	1.068	0.974	0.864	0.780	0.750	0.790	0.836	0.900	1.051	1.01	0.955	0.892	0.818	0.735	0.645	0.550	0.450	0.345	0.235	0.120
+60	1.351	1.459	1.501	1.496	1.452	1.386	1.328	1.322	1.398	1.530	1.715	1.613	1.515	1.432	1.368	1.325	1.300	1.290	1.295	1.310	1.335	1.365	1.395
+50	1.767	1.918	2.011	2.057	2.078	2.064	2.042	2.052	2.092	2.187	2.259	2.252	2.197	2.093	1.983	1.875	1.770	1.668	1.568	1.470	1.375	1.285	1.195
+40	2.249	2.449	2.581	2.644	2.727	2.767	2.778	2.753	2.741	2.738	2.703	2.603	2.461	2.351	2.203	2.035	1.930	1.827	1.706	1.603	1.513	1.433	1.363
+30	2.679	2.901	3.066	3.177	3.267	3.340	3.388	3.415	3.425	3.415	3.380	3.323	3.248	3.158	3.055	2.938	2.806	2.670	2.528	2.383	2.245	2.115	2.000
+20	2.932	3.151	3.328	3.464	3.568	3.657	3.734	3.795	3.838	3.860	3.860	3.838	3.795	3.734	3.655	3.558	3.445	3.318	3.178	3.025	2.868	2.708	2.555
+10	2.952	3.172	3.358	3.504	3.624	3.725	3.808	3.875	3.926	3.961	3.978	3.978	3.958	3.918	3.860	3.785	3.695	3.590	3.470	3.335	3.185	3.030	2.875
0	2.763	2.863	3.019	3.206	3.393	3.563	3.720	3.853	3.973	4.078	4.167	4.240	4.298	4.340	4.365	4.375	4.370	4.350	4.315	4.265	4.200	4.120	4.035
-10	2.452	2.479	2.590	2.765	2.937	3.108	3.276	3.444	3.612	3.779	3.946	4.113	4.280	4.447	4.614	4.781	4.948	5.115	5.282	5.449	5.616	5.783	5.950
-20	2.120	2.081	2.133	2.255	2.418	2.621	2.862	3.109	3.356	3.603	3.850	4.097	4.344	4.591	4.838	5.085	5.332	5.579	5.826	6.073	6.320	6.567	6.814
-30	1.871	1.740	1.737	1.787	1.899	2.051	2.250	2.457	2.664	2.871	3.078	3.285	3.492	3.699	3.906	4.113	4.320	4.527	4.734	4.941	5.148	5.355	5.562
-40	1.777	1.590	1.484	1.433	1.421	1.554	1.656	1.744	1.821	1.888	1.945	1.992	2.039	2.086	2.133	2.180	2.227	2.274	2.321	2.368	2.415	2.462	2.509
-50	1.819	1.585	1.404	1.292	1.231	1.300	1.402	1.490	1.567	1.634	1.691	1.738	1.785	1.832	1.879	1.926	1.973	2.020	2.067	2.114	2.161	2.208	2.255
-60	1.967	1.614	1.448	1.344	1.110	0.972	0.940	0.746	0.530	0.448	0.435	0.435	0.435	0.435	0.435	0.435	0.435	0.435	0.435	0.435	0.435	0.435	0.435
-70	1.985	1.727	1.467	1.224	0.932	0.765	0.598	0.350	0.148	0.048	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035
-80	1.736	1.541	1.298	1.025	0.736	0.545	0.354	0.163	0.065	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035
-90	1.159	1.091	0.815	0.571	0.251	0.044	0.237	0.665	0.906	1.037	1.093	1.117	1.117	1.093	1.037	0.906	0.665	0.237	0.044	0.251	0.571	0.815	1.091

TABLE (28) epoch 1900. Western component  $Y_r$  according to theory. Units of the 3rd decimal.

$\phi$	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°	195°	210°	225°	240°	255°	270°	285°	300°	315°	330°	345°
+90	3.344	3.260	3.157	3.045	2.942	2.811	2.660	2.485	2.281	2.048	1.785	1.492	1.169	0.815	0.431	0.028	-0.405	-0.878	-1.385	-1.926	-2.500	-3.107	-3.745
+80	3.381	3.200	3.075	2.943	2.794	2.624	2.420	2.185	1.920	1.625	1.300	0.945	0.561	0.148	-0.295	-0.780	-1.295	-1.840	-2.415	-3.020	-3.655	-4.320	-4.915
+70	3.418	3.185	3.051	2.919	2.760	2.580	2.375	2.140	1.875	1.580	1.255	0.900	0.516	0.103	-0.320	-0.805	-1.320	-1.865	-2.440	-3.045	-3.680	-4.345	-4.940
+60	3.457	3.205	3.015	2.883	2.724	2.544	2.339	2.104	1.839	1.544	1.219	0.864	0.480	0.067	-0.354	-0.839	-1.354	-1.900	-2.475	-3.080	-3.715	-4.380	-4.975
+50	3.522	3.264	3.074	2.942	2.783	2.603	2.398	2.163	1.908	1.613	1.288	0.933	0.549	0.136	-0.281	-0.766	-1.281	-1.826	-2.401	-3.006	-3.641	-4.306	-4.901
+40	3.612	3.343	3.153	2.921	2.783	2.603	2.398	2.163	1.908	1.613	1.288	0.933	0.549	0.136	-0.281	-0.766	-1.281	-1.826	-2.401	-3.006	-3.641	-4.306	-4.901
+30	3.719	3.444	3.254	3.022	2.884	2.704	2.499	2.264	1.999	1.694	1.369	1.014	0.630	0.217	-0.160	-0.645	-1.160	-1.705	-2.280	-2.885	-3.520	-4.185	-4.780
+20	3.853	3.556	3.366	3.134	2.996	2.816	2.611	2.376	2.121	1.826	1.501	1.146	0.762	0.349	-0.074	-0.559	-1.074	-1.619	-2.194	-2.799	-3.434	-4.099	-4.694
+10	3.985	3.657	3.467	3.235	3.097	2.917	2.712	2.477	2.222	1.927	1.602	1.247	0.863	0.450	0.037	-0.378	-0.893	-1.438	-2.013	-2.618	-3.253	-3.918	-4.513
0	4.109	3.751	3.561	3.329	3.191	2.911	2.706	2.471	2.216	1.921	1.596	1.241	0.857	0.444	0.031	-0.381	-0.896	-1.441	-2.016	-2.621	-3.256	-3.921	-4.516
-10	4.109	3.751	3.561	3.329	3.191	2.911	2.706	2.471	2.216	1.921	1.596	1.241	0.857	0.444	0.031	-0.381	-0.896	-1.441	-2.016	-2.621	-3.256	-3.921	-4.516
-20	4.057	3.701	3.511	3.279	3.141	2.861	2.656	2.421	2.166	1.871	1.546	1.191	0.807	0.394	0.001	-0.404	-0.919	-1.464	-2.039	-2.644	-3.279	-3.944	-4.539
-30	4.057	3.701	3.511	3.279	3.141	2.861	2.656	2.421	2.166	1.871	1.546	1.191	0.807	0.394	0.001	-0.404	-0.919	-1.464	-2.039	-2.644	-3.279	-3.944	-4.539
-40	4.026	3.651	3.461	3.229	3.091	2.811	2.606	2.371	2.116	1.821	1.496	1.141	0.757	0.344	0.001	-0.404	-0.919	-1.464	-2.039	-2.644	-3.279	-3.944	-4.539
-50	4.026	3.651	3.461	3.229	3.091	2.811	2.606	2.371	2.116	1.821	1.496	1.141	0.757	0.344	0.001	-0.404	-0.919	-1.464	-2.039	-2.644	-3.279	-3.944	-4.539
-60	4.026	3.651	3.461	3.229	3.091	2.811	2.606	2.371	2.116	1.821	1.496	1.141	0.757	0.344	0.001	-0.404	-0.919	-1.464	-2.039	-2.644	-3.279	-3.944	-4.539
-70	4.026	3.651	3.461	3.229	3.091	2.811	2.606	2.371	2.116	1.821	1.496	1.141	0.757	0.344	0.001	-0.404	-0.919	-1.464	-2.039	-2.644	-3.279	-3.944	-4.539
-80	4.026	3.651	3.461	3.229	3.091	2.811	2.606	2.371	2.116	1.821	1.496	1.141	0.757	0.344	0.001	-0.404	-0.919	-1.464	-2.039	-2.644	-3.279	-3.944	-4.539
-90	4.026	3.651	3.461	3.229	3.091	2.811	2.606	2.371	2.116	1.821	1.496	1.141	0.757	0.344	0.001	-0.404	-0.919	-1.464	-2.039	-2.644	-3.279	-3.944	-4.539

Dr. Fritzsche, Erdmagnetismus 1880-1915.

23

TABLE (30) epoch 1900. Declination  $\delta_r$  according to theory. Degrees in mins. are given by points



TABLE (30) epoch 1900. Declination  $\delta$ , according to theory. Degrees in mins. are separated by pts.

$\varphi$	$\lambda = 0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$
$-10^\circ$	+23.3	+18.30	+13.55	+8.21	+2.55	-2.11	-7.39	-12.45	-17.10	-21.34	-25.04	-28.17	-30.73	-32.73	-34.17	-35.05	-35.37	-35.13	-34.35	-33.03	-31.27	-29.07	-26.44	-23.39
$-20^\circ$	+26.30	+21.35	+16.50	+11.54	+6.43	+1.12	-4.25	-9.39	-14.10	-18.37	-22.10	-25.28	-27.81	-29.70	-30.95	-31.56	-31.56	-30.95	-29.70	-27.81	-25.28	-22.10	-18.37	-14.10
$-30^\circ$	+29.20	+24.25	+19.40	+14.44	+9.33	+4.04	-1.25	-6.49	-11.28	-15.55	-19.20	-22.23	-24.64	-26.42	-27.57	-28.08	-27.95	-27.17	-25.74	-23.67	-21.00	-17.83	-14.16	-10.00
$-40^\circ$	+32.00	+27.05	+22.20	+17.24	+12.17	+7.00	-2.19	-7.43	-12.22	-16.47	-20.17	-23.31	-25.89	-27.81	-29.06	-29.63	-29.52	-28.74	-27.31	-24.24	-20.57	-16.30	-11.44	-6.99
$-50^\circ$	+34.70	+29.75	+24.90	+19.94	+14.87	+9.70	-4.41	-9.65	-14.44	-18.69	-22.39	-25.53	-28.11	-30.13	-31.50	-32.11	-31.87	-30.89	-29.17	-25.70	-21.43	-16.47	-10.92	-5.77
$-60^\circ$	+37.20	+32.25	+27.40	+22.44	+17.37	+12.20	-7.12	-11.91	-16.16	-20.87	-24.57	-27.71	-30.29	-32.31	-33.78	-34.50	-34.47	-33.69	-32.16	-28.69	-23.42	-17.46	-10.92	-5.77
$-70^\circ$	+39.50	+34.55	+29.70	+24.74	+19.67	+14.50	-11.81	-16.60	-21.35	-25.59	-29.29	-32.43	-35.01	-37.03	-38.50	-39.41	-39.47	-38.69	-37.16	-33.69	-28.42	-22.46	-15.92	-9.77
$-80^\circ$	+41.50	+36.55	+31.70	+26.74	+21.67	+16.50	-14.71	-19.50	-24.25	-28.49	-32.19	-35.33	-37.91	-40.03	-41.50	-42.41	-42.47	-41.69	-40.16	-36.69	-31.42	-25.46	-18.92	-12.77
$-90^\circ$	+43.20	+38.25	+33.40	+28.44	+23.37	+18.20	-17.12	-21.91	-26.66	-30.91	-34.61	-37.75	-40.33	-42.45	-44.02	-45.03	-45.09	-44.31	-42.78	-39.31	-33.54	-27.58	-21.04	-14.89

TABLE (31) epoch 1900. Inclination  $I$ , according to theory.

$\varphi$	$\lambda = 0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$
$+0^\circ$	+8.12	+8.10	+8.10	+8.10	+8.10	+8.10	+8.10	+8.10	+8.10	+8.10	+8.10	+8.10	+8.10	+8.10	+8.10	+8.10	+8.10	+8.10	+8.10	+8.10	+8.10	+8.10	+8.10	+8.10
$+10^\circ$	+7.14	+7.14	+7.14	+7.14	+7.14	+7.14	+7.14	+7.14	+7.14	+7.14	+7.14	+7.14	+7.14	+7.14	+7.14	+7.14	+7.14	+7.14	+7.14	+7.14	+7.14	+7.14	+7.14	+7.14
$+20^\circ$	+6.16	+6.16	+6.16	+6.16	+6.16	+6.16	+6.16	+6.16	+6.16	+6.16	+6.16	+6.16	+6.16	+6.16	+6.16	+6.16	+6.16	+6.16	+6.16	+6.16	+6.16	+6.16	+6.16	+6.16
$+30^\circ$	+5.18	+5.18	+5.18	+5.18	+5.18	+5.18	+5.18	+5.18	+5.18	+5.18	+5.18	+5.18	+5.18	+5.18	+5.18	+5.18	+5.18	+5.18	+5.18	+5.18	+5.18	+5.18	+5.18	+5.18
$+40^\circ$	+4.20	+4.20	+4.20	+4.20	+4.20	+4.20	+4.20	+4.20	+4.20	+4.20	+4.20	+4.20	+4.20	+4.20	+4.20	+4.20	+4.20	+4.20	+4.20	+4.20	+4.20	+4.20	+4.20	+4.20
$+50^\circ$	+3.22	+3.22	+3.22	+3.22	+3.22	+3.22	+3.22	+3.22	+3.22	+3.22	+3.22	+3.22	+3.22	+3.22	+3.22	+3.22	+3.22	+3.22	+3.22	+3.22	+3.22	+3.22	+3.22	+3.22
$+60^\circ$	+2.24	+2.24	+2.24	+2.24	+2.24	+2.24	+2.24	+2.24	+2.24	+2.24	+2.24	+2.24	+2.24	+2.24	+2.24	+2.24	+2.24	+2.24	+2.24	+2.24	+2.24	+2.24	+2.24	+2.24
$+70^\circ$	+1.26	+1.26	+1.26	+1.26	+1.26	+1.26	+1.26	+1.26	+1.26	+1.26	+1.26	+1.26	+1.26	+1.26	+1.26	+1.26	+1.26	+1.26	+1.26	+1.26	+1.26	+1.26	+1.26	+1.26
$+80^\circ$	+0.28	+0.28	+0.28	+0.28	+0.28	+0.28	+0.28	+0.28	+0.28	+0.28	+0.28	+0.28	+0.28	+0.28	+0.28	+0.28	+0.28	+0.28	+0.28	+0.28	+0.28	+0.28	+0.28	+0.28
$+90^\circ$	+0.30	+0.30	+0.30	+0.30	+0.30	+0.30	+0.30	+0.30	+0.30	+0.30	+0.30	+0.30	+0.30	+0.30	+0.30	+0.30	+0.30	+0.30	+0.30	+0.30	+0.30	+0.30	+0.30	+0.30

TABLE (32) epoch 1900. Horiz. intensity  $T$ , according to theory.

$\varphi$	$\lambda = 0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$
$+0^\circ$	+0.200	+0.210	+0.220	+0.230	+0.240	+0.250	+0.260	+0.270	+0.280	+0.290	+0.300	+0.310	+0.320	+0.330	+0.340	+0.350	+0.360	+0.370	+0.380	+0.390	+0.400	+0.410	+0.420	+0.430
$+10^\circ$	+0.200	+0.210	+0.220	+0.230	+0.240	+0.250	+0.260	+0.270	+0.280	+0.290	+0.300	+0.310	+0.320	+0.330	+0.340	+0.350	+0.360	+0.370	+0.380	+0.390	+0.400	+0.410	+0.420	+0.430
$+20^\circ$	+0.200	+0.210	+0.220	+0.230	+0.240	+0.250	+0.260	+0.270	+0.280	+0.290	+0.300	+0.310	+0.320	+0.330	+0.340	+0.350	+0.360	+0.370	+0.380	+0.390	+0.400	+0.410	+0.420	+0.430
$+30^\circ$	+0.200	+0.210	+0.220	+0.230	+0.240	+0.250	+0.260	+0.270	+0.280	+0.290	+0.300	+0.310	+0.320	+0.330	+0.340	+0.350	+0.360	+0.370	+0.380	+0.390	+0.400	+0.410	+0.420	+0.430

TABLE (32) epoch 1900. Horiz. intensity  $T$ , according to theory.

$\varphi$	$\lambda = 0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$
$+0^\circ$	+0.200	+0.210	+0.220	+0.230	+0.240	+0.250	+0.260	+0.270	+0.280	+0.290	+0.300	+0.310	+0.320	+0.330	+0.340	+0.350	+0.360	+0.370	+0.380	+0.390	+0.400	+0.410	+0.420	+0.430
$+10^\circ$	+0.200	+0.210	+0.220	+0.230	+0.240	+0.250	+0.260	+0.270	+0.280	+0.290	+0.300	+0.310	+0.320	+0.330	+0.340	+0.350	+0.360	+0.370	+0.380	+0.390	+0.400	+0.410	+0.420	+0.430
$+20^\circ$	+0.200	+0.210	+0.220	+0.230	+0.240	+0.250	+0.260	+0.270	+0.280	+0.290	+0.300	+0.310	+0.320	+0.330	+0.340	+0.350	+0.360	+0.370	+0.380	+0.390	+0.400	+0.410	+0.420	+0.430
$+30^\circ$	+0.200	+0.210	+0.220	+0.230	+0.240	+0.250	+0.260	+0.270	+0.280	+0.290	+0.300	+0.310	+0.320	+0.330	+0.340	+0.350	+0.360	+0.370	+0.380	+0.390	+0.400	+0.410	+0.420	+0.430

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TABLE (32) epoch 1900. Horiz. intensity  $I_r$  calculated according to theory.

$\phi$	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350	360
$I_r$	2.231	2.231	2.231	2.231	2.231	2.231	2.231	2.231	2.231	2.231	2.231	2.231	2.231	2.231	2.231	2.231	2.231	2.231	2.231	2.231	2.231	2.231	2.231	2.231	2.231	2.231	2.231	2.231	2.231	2.231	2.231	2.231	2.231	2.231	2.231	2.231	

TABLE (33) epoch 1900.  $T_c$  intensity  $J_r$  according to theory for  $\phi = 30^\circ$   $T_c = 5.55$  for  $\phi = 70^\circ$   $T_c = 6.52$ .

$\phi$	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350	360	
+0°	5.274	5.279	5.285	5.291	5.298	5.304	5.311	5.318	5.325	5.332	5.339	5.346	5.353	5.360	5.367	5.374	5.381	5.388	5.395	5.402	5.409	5.416	5.423	5.430	5.437	5.444	5.451	5.458	5.465	5.472	5.479	5.486	5.493	5.500	5.507	5.514	5.521	5.528
+10	5.274	5.279	5.285	5.291	5.298	5.304	5.311	5.318	5.325	5.332	5.339	5.346	5.353	5.360	5.367	5.374	5.381	5.388	5.395	5.402	5.409	5.416	5.423	5.430	5.437	5.444	5.451	5.458	5.465	5.472	5.479	5.486	5.493	5.500	5.507	5.514	5.521	5.528
+20	5.274	5.279	5.285	5.291	5.298	5.304	5.311	5.318	5.325	5.332	5.339	5.346	5.353	5.360	5.367	5.374	5.381	5.388	5.395	5.402	5.409	5.416	5.423	5.430	5.437	5.444	5.451	5.458	5.465	5.472	5.479	5.486	5.493	5.500	5.507	5.514	5.521	5.528
+30	5.274	5.279	5.285	5.291	5.298	5.304	5.311	5.318	5.325	5.332	5.339	5.346	5.353	5.360	5.367	5.374	5.381	5.388	5.395	5.402	5.409	5.416	5.423	5.430	5.437	5.444	5.451	5.458	5.465	5.472	5.479	5.486	5.493	5.500	5.507	5.514	5.521	5.528
+40	5.274	5.279	5.285	5.291	5.298	5.304	5.311	5.318	5.325	5.332	5.339	5.346	5.353	5.360	5.367	5.374	5.381	5.388	5.395	5.402	5.409	5.416	5.423	5.430	5.437	5.444	5.451	5.458	5.465	5.472	5.479	5.486	5.493	5.500	5.507	5.514	5.521	5.528
+50	5.274	5.279	5.285	5.291	5.298	5.304	5.311	5.318	5.325	5.332	5.339	5.346	5.353	5.360	5.367	5.374	5.381	5.388	5.395	5.402	5.409	5.416	5.423	5.430	5.437	5.444	5.451	5.458	5.465	5.472	5.479	5.486	5.493	5.500	5.507	5.514	5.521	5.528
+60	5.274	5.279	5.285	5.291	5.298	5.304	5.311	5.318	5.325	5.332	5.339	5.346	5.353	5.360	5.367	5.374	5.381	5.388	5.395	5.402	5.409	5.416	5.423	5.430	5.437	5.444	5.451	5.458	5.465	5.472	5.479	5.486	5.493	5.500	5.507	5.514	5.521	5.528
+70	5.274	5.279	5.285	5.291	5.298	5.304	5.311	5.318	5.325	5.332	5.339	5.346	5.353	5.360	5.367	5.374	5.381	5.388	5.395	5.402	5.409	5.416	5.423	5.430	5.437	5.444	5.451	5.458	5.465	5.472	5.479	5.486	5.493	5.500	5.507	5.514	5.521	5.528
+80	5.274	5.279	5.285	5.291	5.298	5.304	5.311	5.318	5.325	5.332	5.339	5.346	5.353	5.360	5.367	5.374	5.381	5.388	5.395	5.402	5.409	5.416	5.423	5.430	5.437	5.444	5.451	5.458	5.465	5.472	5.479	5.486	5.493	5.500	5.507	5.514	5.521	5.528
+90	5.274	5.279	5.285	5.291	5.298	5.304	5.311	5.318	5.325	5.332	5.339	5.346	5.353	5.360	5.367	5.374	5.381	5.388	5.395	5.402	5.409	5.416	5.423	5.430	5.437	5.444	5.451	5.458	5.465	5.472	5.479	5.486	5.493	5.500	5.507	5.514	5.521	5.528
-0	5.274	5.279	5.285	5.291	5.298	5.304	5.311	5.318	5.325	5.332	5.339	5.346	5.353	5.360	5.367	5.374	5.381	5.388	5.395	5.402	5.409	5.416	5.423	5.430	5.437	5.444	5.451	5.458	5.465	5.472	5.479	5.486	5.493	5.500	5.507	5.514	5.521	5.528
-10	5.274	5.279	5.285	5.291	5.298	5.304	5.311	5.318	5.325	5.332	5.339	5.346	5.353	5.360	5.367	5.374	5.381	5.388	5.395	5.402	5.409	5.416	5.423	5.430	5.437	5.444	5.451	5.458	5.465	5.472	5.479	5.486	5.493	5.500	5.507	5.514	5.521	5.528
-20	5.274	5.279	5.285	5.291	5.298	5.304	5.311	5.318	5.325	5.332	5.339	5.346	5.353	5.360	5.367	5.374	5.381	5.388	5.395	5.402	5.409	5.416	5.423	5.430	5.437	5.444	5.451	5.458	5.465	5.472	5.479	5.486	5.493	5.500	5.507	5.514	5.521	5.528
-30	5.274	5.279	5.285	5.291	5.298	5.304	5.311	5.318	5.325	5.332	5.339	5.346	5.353	5.360	5.367	5.374	5.381	5.388	5.395	5.402	5.409	5.416	5.423	5.430	5.437	5.444	5.451	5.458	5.465	5.472	5.479	5.486	5.493	5.500	5.507	5.514	5.521	5.528
-40	5.274	5.279	5.285	5.291	5.298	5.304	5.311	5.318	5.325	5.332	5.339	5.346	5.353	5.360	5.367	5.374	5.381	5.388	5.395	5.402	5.409	5.416	5.423	5.430	5.437	5.444	5.451	5.458	5.465	5.472	5.479	5.486	5.493	5.500	5.507	5.514	5.521	5.528
-50	5.274	5.279	5.285	5.291	5.298	5.304	5.311	5.318	5.325	5.332	5.339	5.346	5.353	5.360	5.367	5.374	5.381	5.388	5.395	5.402	5.409	5.416	5.423	5.430	5.437	5.444	5.451	5.458	5.465	5.472	5.479	5.486	5.493	5.500	5.507	5.514	5.521	5.528
-60	5.274	5.279	5.285	5.291	5.298	5.304	5.311	5.318	5.325	5.332	5.339	5.346	5.353	5.360	5.367	5.374	5.381	5.388	5.395	5.402	5.409	5.416	5.423	5.430	5.437	5.444	5.451	5.458	5.465	5.472	5.479	5.486	5.493	5.500	5.507	5.514	5.521	5.528
-70	5.274	5.279	5.285	5.291	5.298	5.304	5.311	5.318	5.325	5.332	5.339	5.346	5.353	5.360	5.367	5.374	5.381	5.388	5.395	5.402	5.409	5.416	5.423	5.430	5.437	5.444	5.451	5.458	5.465	5.472	5.479	5.486	5.493	5.500	5.507	5.514	5.521	5.528
-80	5.274	5.279	5.285	5.291	5.298	5.304	5.311	5.318	5.325	5.332	5.339	5.346	5.353	5.360	5.367	5.374	5.381	5.388	5.395	5.402	5.409	5.416	5.423	5.430	5.437	5.444	5.451	5.458	5.465	5.472	5.479	5.486	5.493	5.500	5.507	5.514	5.521	5.528
-90	5.274	5.279	5.285	5.291	5.298	5.304	5.311	5.318	5.325	5.332	5.339	5.346	5.353	5.360	5.367	5.374	5.381	5.388	5.395	5.402	5.409	5.416	5.423	5.430	5.437	5.444	5.451	5.458	5.465	5.472	5.479	5.486	5.493	5.500	5.507	5.514	5.521	5.528

The differences between calculation (Tables (30), (31), (32)) and observations (Tables (21), (22), (23)) are given in the following tables (34), (35), (36).

TABLE (34) epoch 1900. Differences between the declination  $\delta_r$  and the observations according to Table (30 and (illegible))

[illegible]

TABLE

(35) Difference  $i_1 - i_2$  between the inclination  $i_1$  according to theory and the observations  $i_2$  epoch 1900. Difference  $i_1 - i_2$  between the inclination  $i_1$  according to theory and the observations  $i_2$  epoch 1900.

[illegible]

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TABLE (36). Differences  $T_r - T_e$  between the horizontal intensity  $T_r$  according to theory and the observed  $T_e$  Epoch 1900. Gauss units of the 2nd decimal

$\phi$	$\lambda = 0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$	
$+80^\circ$	0	-2	0	+2	+3	+2	+4	+4	+4	+1	0	+2	+4	+4	+4	+6	-1	-1	0	-1	+3	+1	0	-2	-3
$+70$	-6	-6	-5	-2	-1	-2	-1	-1	-6	-2	-5	-4	-6	-6	-6	-3	-3	-1	-1	+1	-4	-1	+4	-4	+5
$+60$	-6	-11	-13	-11	-6	-5	-4	-5	-7	-10	-4	-3	-7	-5	-2	-6	-7	-7	-7	-1	-2	-1	-2	-3	-12
$+50$	-6	-5	-4	-7	-7	-5	-2	-13	-12	-4	-4	-9	-5	-6	-6	-2	-3	-4	-4	-2	-5	-9	-1	0	0
$+40$	-3	0	+1	0	-4	-1	-2	-3	-6	-7	-7	-7	-7	-6	-8	-7	-4	-7	-7	-7	-11	-12	+6	-9	-4
$+30$	+6	+7	+5	-1	-7	-8	-8	-8	-8	-5	-6	-10	-8	-7	-4	-3	+3	+1	+1	-8	-6	-5	+3	+7	+5
$+20$	+4	+8	+5	+2	-3	-1	-8	-1	-8	-4	-7	-4	-5	-3	-2	+1	+2	+1	+1	-1	-6	-7	-4	+7	+7
$+10$	-10	-4	+1	+4	+7	-5	-1	-5	0	-3	-7	-4	-5	-4	-4	+1	-5	-3	-3	-4	+1	+3	-5	-8	-7
0	-1	-3	+2	+5	+7	+4	+1	+1	-1	-2	-5	-5	-4	-3	-3	-2	-3	-3	-1	+1	+3	-7	-6	-2	
-10	+4	+3	+4	+5	+5	0	-2	-3	0	0	-1	-2	-6	-6	-5	-1	-3	-3	-3	0	+2	-3	+1	+7	+6
-20	+8	+3	+1	0	+3	-1	+2	+1	0	-4	-5	-7	-7	-6	-7	-1	-1	-5	-5	-5	0	-1	-2	+3	+6
-30	+3	+4	-7	-6	-5	-6	-2	+1	-3	-6	+1	-4	-6	-1	-2	+1	+3	+4	+4	-1	0	+6	+1	+4	+6
-40	+2	-2	-8	-9	-7	-6	-7	-8	-8	-6	-6	-1	+3	0	+3	+5	+7	+6	+6	+2	+6	+1	+5	+6	+6
-50	+5	+2	-1	-5	-5	-5	-5	-7	-6	-5	-4	+2	+2	+3	+5	+7	+7	+7	+7	0	+1	+5	+7	+6	+6
-60	+4	+5	+2	+6	+7	+7	+7	+8	+5	-1	-3	-1	0	0	-3	-4	-4	-4	-3	-3	+1	+7	+7	+6	+6
-70	+6	+6	+4	+3	+4	+3	+3	+4	+6	+7	-5	-6	-3	-2	-2	-4	-3	-5	-3	+3	+7	+4	+4	+3	+6
-80	+4	+3	+3	+2	+1	+3	+2	+3	+4	+5	+4	+5	+6	+5	-1	+1	-2	-1	+1	-1	0	+7	+4	+3	+1



According to the average of 264 points between the latitude +50° and -50° and longitude 0° to 360° according to Table (34), we have  $\delta T - \delta \tau = \pm 0.74 = \pm 44.4$ . Also, according to Table (35), the average of 408 points uniformly distributed over the entire Earth's surface result in the value  $\delta T - \delta \tau = \pm 0.76 = \pm 45.6$ . Finally, the average of all of these differences of Table (36) becomes  $\delta T - \delta \tau = \pm 0.41$  or 2% of T. Almost the same deviations between theory and observation were obtained earlier by me for epochs 1842 and 1885. I also am giving the geographic position of the magnetic Earth's poles for the epochs 1550 and 1900 which I calculated using Tables (13), (14), (27), (28).

/23

Epoch 1550				Epoch 1900			
$\delta T$				$\delta T$			
magnetic North Pole	+76° 18'	241° 54'		mag N. Pole	+69° 18'	263° 33'	
South Pole	-81° 26'	205° 30'		S. Pole	-74° 0'	155° 15'	

d. Earth magnetic elements for the epoch 1915

The Earth magnetic elements for the epoch 1915 which are given in the following tables (37), (38), (39) I obtained by adding the observed elements of epochs 1900 (Tables (21), (22), (23)) to the calculated theoretical difference between epochs 1900 and 1885. If one wishes to interpolate any magnetic elements between 1885 and 1900 and beyond, then one can use the yearly secular changes given in Chapter II in Tables (41), (42), (43), (44), (45), (46), (47), (48), (49), which follow from epochs 1842 and 1885. This is because the secular changes between 1885 and 1900 are very close to the ones between 1842 and 1885. For 1900, one very closely obtains the correct (observed) Earth magnetic elements, if one multiplies the yearly changes found between 1842 and 1885 with 15 and if this added to the elements of the epoch 1885.

TABLE (17). Epoch 1915. Declination  $\delta$

$\delta$	$0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$
$+80^\circ$	+27.1	+11.2	-2.3	-14.6	-23.3	-31.9	-34.7	-34.6	-32.3	-28.8	-23.8	-17.4	-10.4	-5.6	-1.3	+1.8	+4.0	+6.2	+8.4	+10.6	+12.8	+15.0	+17.2	+19.4
$+70^\circ$	+19.9	+7.8	-3.9	-14.1	-22.8	-31.5	-34.3	-34.2	-31.9	-27.4	-21.9	-15.5	-8.5	-3.7	+0.4	+2.6	+4.8	+7.0	+9.2	+11.4	+13.6	+15.8	+18.0	+20.2
$+60^\circ$	+12.2	+7.0	-1.9	-9.7	-15.3	-21.8	-24.6	-24.5	-22.2	-17.7	-12.2	-6.8	-1.4	+1.1	+3.3	+5.5	+7.7	+9.9	+12.1	+14.3	+16.5	+18.7	+20.9	+23.1
$+50^\circ$	+4.6	+7.3	+0.7	-6.0	-9.9	-14.4	-17.2	-17.1	-14.8	-10.3	-5.8	-1.3	+1.2	+3.4	+5.6	+7.8	+10.0	+12.2	+14.4	+16.6	+18.8	+21.0	+23.2	+25.4
$+40^\circ$	+12.2	+7.3	+1.7	-4.9	-6.6	-6.3	-1.1	+4.4	+6.7	+3.7	-1.5	-10.7	-13.9	-16.3	-18.1	-18.0	-15.1	-11.7	-8.3	-4.9	-1.5	+1.9	+4.3	+6.7
$+30^\circ$	+19.2	+7.3	+2.9	-0.6	-2.3	-3.8	-4.5	-1.8	+2.2	+4.6	+1.0	-4.7	-9.6	-11.5	-12.3	-11.4	-8.3	-5.8	-3.3	+0.2	+2.6	+5.0	+7.4	+9.8
$+20^\circ$	+13.7	+8.6	+4.3	+1.1	-0.9	-0.8	-3.5	-2.7	+0.1	+1.1	-1.2	-7.1	-10.6	-12.5	-13.4	-12.5	-9.4	-6.9	-4.4	-1.9	+0.5	+2.9	+5.3	+7.7
$+10^\circ$	+14.5	+10.6	+5.8	+2.7	+0.8	-0.9	-3.3	-3.2	-1.4	-0.8	-1.0	-6.2	-9.0	-10.3	-10.5	-9.4	-6.2	-3.7	-1.2	+1.2	+3.6	+6.0	+8.4	+10.8
$0^\circ$	+18.9	+11.7	+8.1	+4.7	+2.3	+0.8	-1.3	-2.4	-2.6	-2.4	-4.6	-7.1	-7.9	-7.2	-5.4	-5.2	-4.0	-2.8	-1.6	+0.4	+2.8	+5.2	+7.6	+10.0
$-10^\circ$	+23.2	+16.2	+12.0	+8.2	+5.2	+3.2	+1.0	-0.9	-2.3	-3.6	-6.0	-8.1	-8.6	-8.0	-6.5	-6.5	-5.0	-3.2	-1.2	+1.2	+3.6	+6.0	+8.4	+10.8
$-20^\circ$	+26.9	+23.4	+18.0	+13.3	+8.7	+7.2	+4.9	+1.9	-1.3	-4.3	-7.3	-9.6	-9.8	-8.5	-6.8	-6.2	-4.5	-2.7	-0.9	+1.1	+3.5	+5.9	+8.3	+10.7
$-30^\circ$	+31.4	+29.0	+25.9	+21.8	+17.0	+14.2	+12.1	+7.2	+1.2	-4.3	-8.8	-12.0	-12.5	-11.5	-11.0	-10.4	-8.7	-7.0	-5.3	-3.6	-1.9	+0.7	+3.1	+5.5
$-40^\circ$	+37.7	+33.3	+32.3	+30.0	+27.0	+25.0	+21.6	+15.7	+5.7	-3.5	-11.5	-14.9	-15.1	-13.9	-13.3	-13.9	-12.1	-10.4	-8.7	-7.0	-5.3	-3.6	-1.9	+0.7
$-50^\circ$	+42.9	+37.9	+35.7	+30.6	+26.2	+24.0	+20.7	+15.3	-0.1	-12.0	-17.9	-19.1	-18.1	-16.7	-16.3	-17.6	-15.8	-14.1	-12.4	-10.7	-9.0	-7.3	-5.6	-3.9
$-60^\circ$	+47.1	+41.7	+39.5	+33.8	+29.9	+27.2	+23.8	+19.3	+14.5	-10.6	-21.0	-21.7	-20.7	-19.3	-18.9	-20.2	-18.4	-16.7	-15.0	-13.3	-11.6	-9.9	-8.2	-6.5
$-70^\circ$	+51.6	+47.1	+44.9	+38.4	+34.9	+32.1	+28.7	+24.2	+19.7	+13.7	-32.7	-34.8	-34.7	-33.2	-32.7	-34.2	-32.4	-30.7	-29.0	-27.3	-25.6	-23.9	-22.2	-20.5
$-80^\circ$	+55.0	+50.5	+48.3	+41.8	+38.3	+35.5	+32.1	+27.6	+23.1	+17.1	-13.5	-15.1	-15.1	-13.5	-13.5	-15.1	-13.5	-11.8	-10.1	-8.4	-6.7	-5.0	-3.3	-1.6

TABLE (18). Epoch 1915. Declination  $\delta$

$\delta$	$0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$
$+40^\circ$	+81.5	+71.3	+61.2	+51.0	+40.8	+30.6	+20.4	+10.2	+0.1	-10.1	-20.1	-30.1	-40.1	-50.1	-60.1	-70.1	-80.1	-90.1	-100.1	-110.1	-120.1	-130.1	-140.1	-150.1
$+30^\circ$	+76.7	+66.5	+56.4	+46.2	+36.0	+25.8	+15.6	+5.4	-4.8	-14.8	-24.8	-34.8	-44.8	-54.8	-64.8	-74.8	-84.8	-94.8	-104.8	-114.8	-124.8	-134.8	-144.8	-154.8
$+20^\circ$	+71.9	+61.7	+51.6	+41.4	+31.2	+21.0	+10.8	+0.6	-9.6	-19.6	-29.6	-39.6	-49.6	-59.6	-69.6	-79.6	-89.6	-99.6	-109.6	-119.6	-129.6	-139.6	-149.6	-159.6
$+10^\circ$	+67.1	+56.9	+46.8	+36.6	+26.4	+16.2	+6.0	-4.2	-14.2	-24.2	-34.2	-44.2	-54.2	-64.2	-74.2	-84.2	-94.2	-104.2	-114.2	-124.2	-134.2	-144.2	-154.2	-164.2
$0^\circ$	+62.3	+52.1	+42.0	+31.8	+21.6	+11.4	+1.2	-8.8	-18.8	-28.8	-38.8	-48.8	-58.8	-68.8	-78.8	-88.8	-98.8	-108.8	-118.8	-128.8	-138.8	-148.8	-158.8	-168.8
$-10^\circ$	+57.5	+47.3	+37.2	+27.0	+16.8	+6.6	-3.6	-13.6	-23.6	-33.6	-43.6	-53.6	-63.6	-73.6	-83.6	-93.6	-103.6	-113.6	-123.6	-133.6	-143.6	-153.6	-163.6	-173.6
$-20^\circ$	+52.7	+42.5	+32.4	+22.2	+12.0	+1.8	-8.2	-18.2	-28.2	-38.2	-48.2	-58.2	-68.2	-78.2	-88.2	-98.2	-108.2	-118.2	-128.2	-138.2	-148.2	-158.2	-168.2	-178.2
$-30^\circ$	+47.9	+37.7	+27.6	+17.4	+7.2	-3.0	-13.0	-23.0	-33.0	-43.0	-53.0	-63.0	-73.0	-83.0	-93.0	-103.0	-113.0	-123.0	-133.0	-143.0	-153.0	-163.0	-173.0	-183.0
$-40^\circ$	+43.1	+32.9	+22.8	+12.6	+2.4	-7.8	-17.8	-27.8	-37.8	-47.8	-57.8	-67.8	-77.8	-87.8	-97.8	-107.8	-117.8	-127.8	-137.8	-147.8	-157.8	-167.8	-177.8	-187.8
$-50^\circ$	+38.3	+28.1	+18.0	+7.8	-2.4	-12.4	-22.4	-32.4	-42.4	-52.4	-62.4	-72.4	-82.4	-92.4	-102.4	-112.4	-122.4	-132.4	-142.4	-152.4	-162.4	-172.4	-182.4	-192.4
$-60^\circ$	+33.5	+23.3	+13.2	+3.0	-7.2	-17.2	-27.2	-37.2	-47.2	-57.2	-67.2	-77.2	-87.2	-97.2	-107.2	-117.2	-127.2	-137.2	-147.2	-157.2	-167.2	-177.2	-187.2	-197.2
$-70^\circ$	+28.7	+18.5	+8.4	-1.8	-11.8	-21.8	-31.8	-41.8	-51.8	-61.8	-71.8	-81.8	-91.8	-101.8	-111.8	-121.8	-131.8	-141.8	-151.8	-161.8	-171.8	-181.8	-191.8	-201.8
$-80^\circ$	+24.1	+13.9	+3.8	-6.4	-16.4	-26.4	-36.4	-46.4	-56.4	-66.4	-76.4	-86.4	-96.4	-106.4	-116.4	-126.4	-136.4	-146.4	-156.4	-166.4	-176.4	-186.4	-196.4	-206.4

TABLE (31) Epoch 1915 Inclination  $i$

$\lambda$	0°	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°	195°	210°	225°	240°	255°	270°	285°	300°	315°	330°	345°
-10°	-274	-358	-427	-483	-527	-564	-591	-613	-632	-649	-663	-677	-690	-702	-714	-725	-735	-744	-752	-759	-765	-770	-774	-777
-20°	-449	-534	-593	-640	-677	-705	-727	-744	-758	-770	-780	-789	-797	-804	-810	-815	-819	-823	-826	-829	-831	-833	-834	-835
-30°	-683	-769	-828	-875	-912	-940	-959	-977	-992	-1005	-1016	-1025	-1033	-1040	-1045	-1049	-1052	-1055	-1057	-1059	-1060	-1061	-1062	-1062
-40°	-975	-1062	-1121	-1168	-1205	-1233	-1253	-1270	-1284	-1296	-1306	-1314	-1321	-1327	-1332	-1336	-1339	-1341	-1343	-1344	-1345	-1346	-1346	-1346
-50°	-1324	-1411	-1470	-1517	-1554	-1582	-1602	-1619	-1633	-1645	-1655	-1663	-1670	-1676	-1681	-1685	-1688	-1690	-1691	-1692	-1693	-1693	-1693	-1693
-60°	-1739	-1826	-1885	-1932	-1969	-2007	-2035	-2055	-2072	-2087	-2099	-2109	-2117	-2124	-2129	-2133	-2136	-2138	-2139	-2140	-2140	-2140	-2140	-2140
-70°	-2220	-2307	-2366	-2413	-2450	-2488	-2516	-2536	-2553	-2568	-2581	-2592	-2601	-2608	-2613	-2617	-2620	-2622	-2623	-2624	-2624	-2624	-2624	-2624
-80°	-2270	-2357	-2416	-2463	-2500	-2538	-2566	-2586	-2603	-2618	-2631	-2642	-2651	-2658	-2663	-2667	-2670	-2672	-2673	-2674	-2674	-2674	-2674	-2674

TABLE (32) Epoch 1915 Horizon distance  $\rho$

$\lambda$	0°	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°	195°	210°	225°	240°	255°	270°	285°	300°	315°	330°	345°
+0°	0.81	0.76	0.72	0.68	0.64	0.61	0.58	0.55	0.52	0.50	0.47	0.45	0.42	0.40	0.37	0.35	0.32	0.30	0.27	0.25	0.22	0.20	0.17	0.15
+10°	1.17	1.16	1.15	1.08	1.00	0.92	0.84	0.76	0.68	0.60	0.52	0.45	0.37	0.30	0.22	0.15	0.08	0.01	-0.06	-0.13	-0.20	-0.27	-0.34	-0.40
+20°	1.57	1.61	1.64	1.59	1.51	1.43	1.35	1.27	1.19	1.10	1.02	0.94	0.86	0.78	0.70	0.62	0.54	0.46	0.38	0.30	0.22	0.14	0.06	-0.02
+30°	2.00	2.05	2.11	2.13	2.13	2.10	2.06	2.02	1.97	1.92	1.87	1.82	1.77	1.72	1.67	1.62	1.57	1.52	1.47	1.42	1.37	1.32	1.27	1.22
+40°	2.39	2.45	2.52	2.57	2.61	2.64	2.66	2.67	2.68	2.69	2.69	2.69	2.69	2.68	2.67	2.66	2.65	2.64	2.63	2.62	2.61	2.60	2.59	2.58
+50°	2.74	2.80	2.87	2.91	2.94	2.96	2.97	2.98	2.99	2.99	2.99	2.99	2.99	2.98	2.97	2.96	2.95	2.94	2.93	2.92	2.91	2.90	2.89	2.88
+60°	3.04	3.10	3.17	3.21	3.24	3.26	3.27	3.28	3.28	3.28	3.28	3.28	3.28	3.27	3.26	3.25	3.24	3.23	3.22	3.21	3.20	3.19	3.18	3.17
+70°	3.29	3.35	3.42	3.46	3.49	3.51	3.52	3.53	3.53	3.53	3.53	3.53	3.53	3.52	3.51	3.50	3.49	3.48	3.47	3.46	3.45	3.44	3.43	3.42
+80°	3.44	3.50	3.57	3.61	3.64	3.66	3.67	3.68	3.68	3.68	3.68	3.68	3.68	3.67	3.66	3.65	3.64	3.63	3.62	3.61	3.60	3.59	3.58	3.57
+90°	3.59	3.65	3.72	3.76	3.79	3.81	3.82	3.83	3.83	3.83	3.83	3.83	3.83	3.82	3.81	3.80	3.79	3.78	3.77	3.76	3.75	3.74	3.73	3.72
+100°	3.74	3.80	3.87	3.91	3.94	3.96	3.97	3.98	3.98	3.98	3.98	3.98	3.98	3.97	3.96	3.95	3.94	3.93	3.92	3.91	3.90	3.89	3.88	3.87
+110°	3.89	3.95	4.02	4.06	4.09	4.11	4.12	4.13	4.13	4.13	4.13	4.13	4.13	4.12	4.11	4.10	4.09	4.08	4.07	4.06	4.05	4.04	4.03	4.02
+120°	4.04	4.10	4.17	4.21	4.24	4.26	4.27	4.28	4.28	4.28	4.28	4.28	4.28	4.27	4.26	4.25	4.24	4.23	4.22	4.21	4.20	4.19	4.18	4.17
+130°	4.19	4.25	4.32	4.36	4.39	4.41	4.42	4.43	4.43	4.43	4.43	4.43	4.43	4.42	4.41	4.40	4.39	4.38	4.37	4.36	4.35	4.34	4.33	4.32
+140°	4.34	4.40	4.47	4.51	4.54	4.56	4.57	4.58	4.58	4.58	4.58	4.58	4.58	4.57	4.56	4.55	4.54	4.53	4.52	4.51	4.50	4.49	4.48	4.47
+150°	4.49	4.55	4.62	4.66	4.69	4.71	4.72	4.73	4.73	4.73	4.73	4.73	4.73	4.72	4.71	4.70	4.69	4.68	4.67	4.66	4.65	4.64	4.63	4.62
+160°	4.64	4.70	4.77	4.81	4.84	4.86	4.87	4.88	4.88	4.88	4.88	4.88	4.88	4.87	4.86	4.85	4.84	4.83	4.82	4.81	4.80	4.79	4.78	4.77
+170°	4.79	4.85	4.92	4.96	4.99	5.01	5.02	5.03	5.03	5.03	5.03	5.03	5.03	5.02	5.01	5.00	4.99	4.98	4.97	4.96	4.95	4.94	4.93	4.92
+180°	4.94	5.00	5.07	5.11	5.14	5.16	5.17	5.18	5.18	5.18	5.18	5.18	5.18	5.17	5.16	5.15	5.14	5.13	5.12	5.11	5.10	5.09	5.08	5.07
+190°	5.09	5.15	5.22	5.26	5.29	5.31	5.32	5.33	5.33	5.33	5.33	5.33	5.33	5.32	5.31	5.30	5.29	5.28	5.27	5.26	5.25	5.24	5.23	5.22
+200°	5.24	5.30	5.37	5.41	5.44	5.46	5.47	5.48	5.48	5.48	5.48	5.48	5.48	5.47	5.46	5.45	5.44	5.43	5.42	5.41	5.40	5.39	5.38	5.37
+210°	5.39	5.45	5.52	5.56	5.59	5.61	5.62	5.63	5.63	5.63	5.63	5.63	5.63	5.62	5.61	5.60	5.59	5.58	5.57	5.56	5.55	5.54	5.53	5.52
+220°	5.54	5.60	5.67	5.71	5.74	5.76	5.77	5.78	5.78	5.78	5.78	5.78	5.78	5.77	5.76	5.75	5.74	5.73	5.72	5.71	5.70	5.69	5.68	5.67
+230°	5.69	5.75	5.82	5.86	5.89	5.91	5.92	5.93	5.93	5.93	5.93	5.93	5.93	5.92	5.91	5.90	5.89	5.88	5.87	5.86	5.85	5.84	5.83	5.82
+240°	5.84	5.90	5.97	6.01	6.04	6.06	6.07	6.08	6.08	6.08	6.08	6.08	6.08	6.07	6.06	6.05	6.04	6.03	6.02	6.01	6.00	5.99	5.98	5.97
+250°	5.99	6.05	6.12	6.16	6.19	6.21	6.22	6.23	6.23	6.23	6.23	6.23	6.23	6.22	6.21	6.20	6.19	6.18	6.17	6.16	6.15	6.14	6.13	6.12
+260°	6.14	6.20	6.27	6.31	6.34	6.36	6.37	6.38	6.38	6.38	6.38	6.38	6.38	6.37	6.36	6.35	6.34	6.33	6.32	6.31	6.30	6.29	6.28	6.27
+270°	6.29	6.35	6.42	6.46	6.49	6.51	6.52	6.53	6.53	6.53	6.53	6.53	6.53	6.52	6.51	6.50	6.49	6.48	6.47	6.46	6.45	6.44	6.43	6.42
+280°	6.44	6.50	6.57	6.61	6.64	6.66	6.67	6.68	6.68	6.68	6.68	6.68	6.68	6.67	6.66	6.65	6.64	6.63	6.62	6.61	6.60	6.59	6.58	6.57
+290°	6.59	6.65	6.72	6.76	6.79	6.81	6.82	6.83	6.83	6.83	6.83	6.83	6.83	6.82	6.81	6.80	6.79	6.78	6.77	6.76	6.75	6.74	6.73	6.72
+300°	6.74	6.80	6.87	6.91	6.94	6.96	6.97	6.98	6.98	6.98	6.98	6.98	6.98	6.97	6.96	6.95	6.94	6.93	6.92	6.91	6.90	6.89	6.88	6.87
+310°	6.89	6.95	7.02	7.06	7.09	7.11	7.12	7.13	7.13	7.13	7.13	7.13	7.13	7.12	7.11	7.10	7.09	7.08	7.07	7.06	7.05	7.04	7.03	7.02
+320°	7.04	7.10	7.17	7.21	7.24	7.26	7.27	7.28	7.28	7.28	7.28	7.28	7.28	7.27	7.26	7.25	7.24	7.23	7.22	7.21	7.20	7.19	7.18	7.17
+330°	7.19	7.25	7.32	7.36	7.39	7.41	7.42	7.43	7.43	7.43	7.43	7.43	7.43	7.42	7.41	7.40	7.39	7.38	7.37	7.36	7.35	7.34	7.33	7.32
+340°	7.34	7.40	7.47	7.51	7.54	7.56	7.57	7.58	7.58	7.58	7.58	7.58	7.58	7.57	7.56	7.55	7.54	7.53	7.52	7.51	7.50	7.49	7.48	7.47
+350°	7.49	7.55	7.62	7.66	7.69	7.71	7.72	7.73	7.73	7.73	7.73	7.73	7.73	7.72	7.71	7.70	7.69	7.68	7.67	7.66	7.65	7.64	7.63	7.62
+360°	7.64	7.70	7.77	7.81	7.84	7.86	7.87	7.88	7.88	7.88	7.88	7.88	7.88	7.87	7.86	7.85	7.84	7.83	7.82	7.81	7.80	7.79	7.78	7.77

e. Coefficients  $g_n$  of the theory for epochs: 1550, 1600, 1650, 1700, 1750, 1800, 1850, 1900, 1950, 2000, 2050, 2100, 2150, 2200, 2250, 2300, 2350, 2400, 2450, 2500, 2550, 2600, 2650, 2700, 2750, 2800, 2850, 2900, 2950, 3000, 3050, 3100, 3150, 3200, 3250, 3300, 3350, 3400, 3450, 3500, 3550, 3600, 3650, 3700, 3750, 3800, 3850, 3900, 3950, 4000, 4050, 4100, 4150, 4200, 4250, 4300, 4350, 4400, 4450, 4500, 4550, 4600, 4650, 4700, 4750, 4800, 4850, 4900, 4950, 5000, 5050, 5100, 5150, 5200, 5250, 5300, 5350, 5400, 5450, 5500, 5550, 5600, 5650, 5700, 5750, 5800, 5850, 5900, 5950, 6000, 6050, 6100, 6150, 6200, 6250, 6300, 6350, 6400, 6450, 6500, 6550, 6600, 6650, 6700, 6750, 6800, 6850, 6900, 6950, 7000, 7050, 7100, 7150, 7200, 7250, 7300, 7350, 7400, 7450, 7500, 7550, 7600, 7650, 7700, 7750, 7800, 7850, 7900, 7950, 8000, 8050, 8100, 8150, 8200, 8250, 8300, 8350, 8400, 8450, 8500, 8550, 8600, 8650, 8700, 8750, 8800, 8850, 8900, 8950, 9000, 9050, 9100, 9150, 9200, 9250, 9300, 9350, 9400, 9450, 9500, 9550, 9600, 9650, 9700, 9750, 9800, 9850, 9900, 9950, 10000.

ORIGINAL PAGE 12  
OF POOR QUALITY

126

$g_{100}$	$g_{12}$	$g_{13}$	$g_{14}$	$g_{15}$	$g_{16}$	$g_{17}$	$g_{18}$	$g_{19}$	$g_{20}$	$g_{21}$	$g_{22}$	$g_{23}$	$g_{24}$	$g_{25}$	$g_{26}$	$g_{27}$	$g_{28}$	$g_{29}$	$g_{30}$	$g_{31}$	$g_{32}$	$g_{33}$	$g_{34}$	$g_{35}$	$g_{36}$	$g_{37}$	$g_{38}$	$g_{39}$	$g_{40}$	
1550	+0.1334	-0.1033	-0.1247	-0.1461	+0.1923	+0.2473	+0.0438	+0.0171	+0.2058	-0.0381	-0.0831	+0.0533	+0.0585																	
1600	+0.1845	-0.1095	-0.1260	-0.1867	+0.1650	+0.1949	+0.0204	+0.2063	+0.0184	+0.1211	-0.0218	-0.0712	+0.0579	+0.0747																
1650	+0.1856	-0.1173	-0.1751	-0.2374	+0.1234	+0.1369	-0.0088	+0.1607	+0.0065	+0.0152	-0.0014	-0.0563	+0.0636	+0.0949																
1700	+0.1394	-0.1630	-0.1508	-0.2317	+0.1470	+0.0469	-0.0382	+0.2274	+0.0352	+0.0512	+0.0123	-0.0204	+0.0314	+0.1085																
1750	+0.0798	-0.2178	-0.2280	-0.3437	+0.0661	-0.0708	-0.0427	+0.1463	+0.0357	+0.0004	+0.0218	+0.0274	-0.0407	+0.1754																
1800	-0.0066	-0.2660	-0.1647	-0.2342	+0.1028	-0.1148	-0.0400	+0.0936	-0.0293	-0.0189	+0.0304	-0.0038	+0.1411																	
1850	-0.0589	-0.2667	-0.2128	-0.1961	+0.0572	-0.1210	+0.0013	+0.0658	+0.0227	-0.1122	-0.0328	+0.0601	-0.0372	+0.1502																
1900	-0.0772	-0.2669	-0.2296	-0.1618	+0.0391	-0.1259	+0.0158	+0.0546	+0.0409	-0.1412	-0.0431	+0.0705	-0.0354	+0.1513																
1200	+0.0251	-0.0119	+0.0961	+0.0332	-0.0059	-0.0040	+0.0259	+0.0202	+0.0248	-0.0499	-0.0051	-0.0104	-0.0282	-0.0224																
0551	+0.0123	+0.0194	+0.0566	+0.0469	-0.0057	-0.0021	+0.0373	+0.0313	+0.0261	-0.0247	-0.0131	-0.0049	-0.0190	-0.0215																
0071	-0.0037	+0.0585	+0.0078	+0.0560	-0.0005	+0.0003	+0.0023	+0.0152	+0.0277	+0.0068	-0.0236	+0.0020	-0.0075	-0.0226																
0597	-0.0170	+0.0436	-0.0139	+0.0481	+0.0121	+0.0025	+0.0237	+0.0154	+0.0157	+0.0035	-0.0113	+0.0067	+0.0017	-0.0194																
0041	-0.0471	+0.0597	-0.0168	+0.0095	+0.0117	+0.0020	-0.0066	+0.0207	+0.0332	+0.0015	-0.0015	-0.0061	+0.0049	-0.0111																
0241	-0.0699	+0.0429	+0.0193	+0.0322	0.0000	+0.0109	+0.0191	+0.0103	+0.0142	+0.0127	-0.0176	-0.0035	-0.0042	-0.0169																
5281	-0.0555	+0.0525	-0.0049	+0.0757	-0.0043	+0.0134	+0.0200	+0.0103	+0.0132	+0.0346	-0.0064	-0.0034	-0.0043	-0.0186																
0091	-0.0505	+0.0559	-0.0134	+0.0819	-0.0028	+0.0143	+0.0203	+0.0103	+0.0129	+0.0423	-0.0060	-0.0031	-0.0043	-0.0192																



Chapter II

/26

a. Secular changes of the Earth's magnetic element between 1550-1900. The secular changes  $\Delta P, \Delta F, \Delta X, \Delta Y, \Delta Z, \Delta d, \Delta i, \Delta T$  and  $\Delta J$  of the Earth's magnetic elements  $P, F, X, Y, Z, d, i, T$  and  $J$ , when time is increased by one year was obtained using Publication II according to the theoretical tables (27)<sub>e</sub>, (28)<sub>e</sub>, (29)<sub>e</sub>, (30)<sub>e</sub>, (31)<sub>e</sub>, (32)<sub>e</sub>, (33)<sub>e</sub>,

(34)<sub>e</sub>, (35)<sub>e</sub> pag. 52-53

and the tables (13)-

(19) Chapter Ib and (27)-(33) Chapter Ic of this third publication. I have entered this into the following nine tables (41) to (49).

TABLE (41). Secular changes  $\Delta T$  of the potential when the time is increased by one year in GE units of the 5th decimal, for 1600-1650. For  $\varphi = +90^\circ$  we have  $\Delta T = +0.000265$ . For  $\varphi = -90^\circ$  we have  $\Delta T = +0.000095$ .

18

TABLE (41). Yearly secular changes  $\Delta T$  between 1600-1650. GE of the 5th decimal

$\varphi$	$\lambda = 0^\circ$	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°	195°	210°	225°	240°	255°	270°	285°	300°	315°	330°	345°
+90°	+18	+16	+14	+12	+10	+8	+6	+4	+2	+1	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13	+14
+80°	+10	+8	+6	+4	+2	+1	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13	+14	+15	+16	+17	+18
+70°	+4	+2	+1	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13	+14	+15	+16	+17	+18	+19	+20	+21
+60°	+2	+1	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13	+14	+15	+16	+17	+18	+19	+20	+21	+22
+50°	+1	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13	+14	+15	+16	+17	+18	+19	+20	+21	+22	+23
0	+1	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13	+14	+15	+16	+17	+18	+19	+20	+21	+22	+23
-10°	+1	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13	+14	+15	+16	+17	+18	+19	+20	+21	+22	+23
-20°	+1	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13	+14	+15	+16	+17	+18	+19	+20	+21	+22	+23
-30°	+1	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13	+14	+15	+16	+17	+18	+19	+20	+21	+22	+23
-40°	+1	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13	+14	+15	+16	+17	+18	+19	+20	+21	+22	+23
-50°	+1	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13	+14	+15	+16	+17	+18	+19	+20	+21	+22	+23
-60°	+1	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13	+14	+15	+16	+17	+18	+19	+20	+21	+22	+23
-70°	+1	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13	+14	+15	+16	+17	+18	+19	+20	+21	+22	+23
-80°	+1	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13	+14	+15	+16	+17	+18	+19	+20	+21	+22	+23
-90°	+1	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13	+14	+15	+16	+17	+18	+19	+20	+21	+22	+23

TABLE (41). Secular changes  $\Delta T$  of the potential between 1650-1700 when the time is increased by one year. GE of the 5th decimal

$\phi$	$\lambda = 0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$
$+90^\circ$	-6	-18	-22	-24	-24	-23	-23	-23	-32	-32	-30	-22	-14	-2	+14	+28	+40	+48	+52	+48	+40	+28	+14	+2
$+80$	-10	-22	-24	-24	-24	-23	-23	-23	-32	-32	-30	-22	-14	-2	+14	+28	+40	+48	+52	+48	+40	+28	+14	+2
$+70$	-12	-24	-24	-24	-24	-23	-23	-23	-32	-32	-30	-22	-14	-2	+14	+28	+40	+48	+52	+48	+40	+28	+14	+2
$+60$	-14	-26	-26	-26	-26	-25	-25	-25	-34	-34	-32	-24	-16	-4	+16	+32	+44	+52	+56	+52	+44	+32	+16	+4
$+50$	-16	-28	-28	-28	-28	-27	-27	-27	-36	-36	-34	-26	-18	-6	+18	+36	+48	+56	+60	+56	+48	+36	+18	+6
$+40$	-18	-30	-30	-30	-30	-29	-29	-29	-38	-38	-36	-28	-20	-8	+20	+40	+52	+60	+64	+60	+52	+40	+20	+8
$+30$	-20	-32	-32	-32	-32	-31	-31	-31	-40	-40	-38	-30	-22	-10	+22	+44	+56	+64	+68	+64	+56	+44	+22	+10
$+20$	-22	-34	-34	-34	-34	-33	-33	-33	-42	-42	-40	-32	-24	-12	+24	+48	+60	+68	+72	+68	+60	+48	+24	+12
$+10$	-24	-36	-36	-36	-36	-35	-35	-35	-44	-44	-42	-34	-26	-14	+26	+52	+64	+72	+76	+72	+64	+52	+26	+14
$0$	-26	-38	-38	-38	-38	-37	-37	-37	-46	-46	-44	-36	-28	-16	+28	+56	+68	+76	+80	+76	+68	+56	+28	+16
$-10$	-28	-40	-40	-40	-40	-39	-39	-39	-48	-48	-46	-38	-30	-18	+30	+60	+72	+80	+84	+80	+72	+60	+30	+18
$-20$	-30	-42	-42	-42	-42	-41	-41	-41	-50	-50	-48	-40	-32	-20	+20	+40	+52	+60	+64	+60	+52	+40	+20	+10
$-30$	-32	-44	-44	-44	-44	-43	-43	-43	-52	-52	-50	-42	-34	-22	+22	+44	+56	+64	+68	+64	+56	+44	+22	+12
$-40$	-34	-46	-46	-46	-46	-45	-45	-45	-54	-54	-52	-44	-36	-24	+24	+48	+60	+68	+72	+68	+60	+48	+24	+14
$-50$	-36	-48	-48	-48	-48	-47	-47	-47	-56	-56	-54	-46	-38	-26	+26	+52	+64	+72	+76	+72	+64	+52	+26	+16
$-60$	-38	-50	-50	-50	-50	-49	-49	-49	-58	-58	-56	-48	-40	-28	+28	+56	+68	+76	+80	+76	+68	+56	+28	+18
$-70$	-40	-52	-52	-52	-52	-51	-51	-51	-60	-60	-58	-50	-42	-30	+30	+60	+72	+80	+84	+80	+72	+60	+30	+20
$-80$	-42	-54	-54	-54	-54	-53	-53	-53	-62	-62	-60	-52	-44	-32	+32	+64	+76	+84	+88	+84	+76	+64	+32	+22
$-90$	-44	-56	-56	-56	-56	-55	-55	-55	-64	-64	-62	-54	-46	-34	+34	+68	+80	+88	+92	+88	+80	+68	+34	+24

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TABLE (41). Yearly secular changes  $\Delta T$  between 1700-1780. GE of the 5th decimal. For  $\phi=+90^\circ$  we have  $\delta\sigma=-0.00066$  for  $\lambda=30^\circ$  we have  $\delta\sigma=-0.00034$

$\phi$	$\lambda=0^\circ$	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°	195°	210°	225°	240°	255°	270°	285°	300°	315°	330°	345°
+80°	-110	-113	-111	-104	-91	-75	-57	-42	-31	-23	-21	-25	-27	-30	-34	-36	-39	-42	-50	-60	-69	-81	-94	-102
+70	-137	-152	-155	-140	-111	-72	-32	0	+14	+17	+7	-7	-22	-32	-27	-25	-16	-12	-12	-30	-36	-57	-85	-112
+60	-138	-176	-152	-175	-129	-67	-9	+30	+47	+36	+6	-29	-54	-64	-67	-67	-19	+11	+32	+50	+47	+14	-29	-96
+50	-126	-185	-173	-195	-142	-70	0	+45	+55	+29	-23	-80	-111	-115	-81	-29	+27	+70	+97	+110	+115	+86	+35	-45
+40	-94	-174	-232	-212	-157	-76	-2	+44	+55	+10	-57	-120	-166	-159	-107	-35	+37	+99	+148	+179	+183	+162	+97	+6
+30	-74	-171	-239	-229	-174	-87	-9	+32	+26	-17	-92	-158	-200	-191	-125	-35	+54	+120	+179	+224	+243	+148	+41	+148
+20	-55	-166	-243	-236	-200	-110	-23	+17	+11	-31	-104	-171	-201	-183	-116	-31	+56	+137	+205	+262	+282	+234	+180	+64
+10	-39	-169	-260	-248	-222	-120	-36	+7	+5	-35	-100	-164	-182	-155	-85	-7	+67	+144	+228	+292	+314	+277	+199	+85
0	-16	-158	-268	-258	-232	-148	-64	-17	-6	-35	-81	-133	-143	-106	-39	+22	+72	+152	+243	+317	+338	+300	+218	+114
-10	+6	-157	-255	-251	-259	-171	-101	-59	-32	-39	-70	-107	-104	-62	0	+44	+85	+151	+243	+328	+356	+320	+244	+137
-20	+27	-157	-232	-229	-251	-195	-146	-106	-76	-64	-72	-87	-70	-27	+20	+51	+84	+146	+243	+320	+363	+336	+260	+157
-30	+42	-87	-183	-226	-223	-202	-179	-151	-114	-87	-74	-70	-52	-17	+11	+37	+71	+141	+243	+336	+376	+372	+274	+169
-40	+79	-36	-123	-173	-194	-198	-197	-183	-153	-123	-105	-91	-74	-47	-15	+15	+62	+136	+237	+330	+377	+364	+272	+192
-50	+129	+34	-45	-95	-129	-160	-176	-182	-163	-142	-121	-104	-81	-56	-21	+15	+69	+148	+238	+325	+363	+362	+271	+226
-60	+163	+91	+30	-26	-69	-106	-149	-141	-133	-131	-120	-104	-81	-54	-23	+21	+81	+154	+230	+293	+330	+330	+238	+236
-70	+185	+136	+86	+44	+2	-34	-60	-79	-87	-89	-84	-69	-50	-26	+2	+47	+95	+149	+199	+241	+269	+274	+261	+228
-80	+155	+132	+107	+82	+54	+35	+15	0	-9	-10	-7	0	+12	+30	+50	+72	+101	+127	+152	+173	+196	+189	+185	+173

TABLE (41). Yearly secular changes  $\Delta T$  between 1780-1842. GE of the 5th decimal. For  $\phi=30^\circ$  we have  $\delta\sigma=-0.00010$ , for  $\lambda=30^\circ$  we have  $\delta\sigma=-0.00046$

$\phi$	$\lambda=0^\circ$	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°	195°	210°	225°	240°	255°	270°	285°	300°	315°	330°	345°
+80°	+27	+19	+5	-2	-8	-11	-16	-18	-18	-21	-24	-26	-24	-23	-18	-8	+2	+15	+26	+34	+43	+43	+43	+36
+70	+10	-8	-19	-26	-26	-27	-26	-27	-26	-23	-29	-34	-39	-40	-42	-29	-10	+18	+42	+43	+71	+65	+22	+31
+60	-18	-36	-47	-47	-36	-21	-5	+5	+6	+2	-3	-16	-31	-45	-55	-55	-36	+5	+40	+63	+77	+68	+42	+13
+50	-71	-90	-82	-56	-16	+21	+50	+63	+65	+53	+43	+32	+10	-13	-40	-47	-29	+5	+50	+79	+84	+63	+15	-39
+40	-144	-166	-127	-65	+6	+68	+108	+132	+126	+113	+92	+82	+69	+50	+15	-3	+3	+36	+69	+87	+77	+45	-11	-82
+30	-236	-255	-191	-82	+26	+106	+158	+183	+183	+156	+137	+123	+104	+726	+95	+56	+45	+68	+87	+87	+68	+24	-53	-155
+20	-323	-353	-263	-108	+34	+129	+177	+203	+204	+185	+169	+166	+180	+185	+163	+124	+105	+103	+106	+94	+63	+18	-76	-204
+10	-398	-427	-328	-132	+15	+108	+156	+182	+191	+167	+156	+163	+188	+195	+166	+132	+118	+118	+108	+82	+32	-29	-253	-253
0	-445	-459	-345	-156	-13	+73	+113	+140	+152	+147	+129	+134	+145	+150	+132	+115	+123	+134	+135	+131	+113	+56	-71	-263
-10	-589	-485	-325	-163	-32	+42	+63	+81	+87	+85	+79	+81	+82	+84	+69	+79	+100	+132	+153	+158	+142	+89	-43	-228
-20	-746	-539	-364	-226	-26	+21	+29	+34	+39	+39	+32	+29	+19	+13	+6	+36	+71	+131	+171	+195	+187	+139	+19	-148
-30	-120	-219	-182	-103	-42	-70	-2	0	-3	-10	-18	-23	-32	-39	-40	-13	+39	+100	+150	+180	+187	+152	+60	-68
-40	-95	-124	-111	-74	-40	-23	-21	-19	-31	-36	-40	-47	-56	-66	-66	-39	+5	+58	+108	+139	+150	+123	+56	-21
-50	-65	-85	-89	-76	-60	-50	-45	-47	-53	-60	-66	-66	-74	-82	-89	-73	-40	-2	+29	+47	+63	+53	+24	-24
-60	-79	-89	-97	-87	-77	-68	-66	-65	-68	-74	-84	-92	-98	-102	-103	-97	-90	-77	-66	-55	-39	-45	-60	-60
-70	-126	-131	-127	-123	-121	-111	-106	-103	-102	-100	-102	-111	-116	-121	-131	-139	-137	-135	-129	-123	-118	-116	-118	-121
-80	-156	-153	-150	-148	-145	-142	-139	-139	-142	-144	-147	-150	-156	-156	-156	-158	-161	-161	-161	-158	-161	-158	-156	-156

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TABLE (41) Yearly secular changes  $\Delta T$  between 1842-1885. GE of the 5th decimal. For  $\varphi=+30$ ,  $\Delta T=-0.00142$ ; for  $\varphi=+30$ ,  $\Delta T=+0.00170$ .

$\varphi$	A=0°	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°	195°	210°	225°	240°	255°	270°	285°	300°	315°	330°	345°	
+80°	-139	-137	-126	-119	-112	-110	-107	-110	-112	-119	-126	-133	-139	-142	-149	-151	-154	-151	-154	-151	-154	-151	-154	-149	-147
+70°	-126	-107	-90	-72	-58	-47	-49	-52	-63	-81	-95	-114	-131	-139	-147	-151	-154	-151	-154	-151	-154	-151	-154	-149	-139
+60°	-135	-122	-63	-38	-7	+14	+21	+19	+7	-23	-54	-83	-112	-126	-137	-151	-154	-151	-154	-151	-154	-151	-154	-149	-139
+50°	-141	-112	-56	0	+35	+54	+70	+67	+54	+33	-19	-52	-81	-97	-102	-112	-110	-135	-135	-135	-135	-135	-135	-135	-135
+40°	-228	-156	-70	+7	+63	+95	+116	+114	+95	+54	+9	-30	-61	-77	-79	-81	-77	-77	-79	-79	-79	-79	-79	-79	-79
+30°	-262	-191	-93	+5	+72	+116	+133	+119	+128	+102	+52	-5	-54	-70	-70	-56	-40	-32	-40	-40	-40	-40	-40	-40	-40
+20°	-309	-230	-114	-9	+63	+100	+112	+128	+123	+107	+58	-8	-58	-90	-90	-65	-35	-12	-14	-14	-14	-14	-14	-14	-14
+10°	-325	-246	-149	-37	+35	+67	+81	+35	+100	+107	+65	+5	-61	-97	-97	-51	-23	-12	-12	-12	-12	-12	-12	-12	-12
0	-327	-247	-151	-38	+34	+67	+82	+33	+42	+58	+44	-7	-61	-90	-90	-50	-52	-23	+19	+44	+22	-31	-128	-230	-235
-10°	-273	-235	-163	-70	-19	-12	-16	-16	-23	+23	+28	+8	-37	-65	-65	-42	-23	+10	+45	+85	+45	-28	-149	-237	-243
-20°	-217	-198	-144	-91	-58	-49	-47	-40	-25	-5	+9	+4	-2	-12	-12	-12	-12	+72	+128	+122	+203	+179	-51	-166	-171
-30°	-142	-161	-116	-67	-25	-16	-21	-25	-16	+7	+32	+44	+49	+53	+79	+110	+156	+212	+230	+233	+204	+212	+70	-61	-63
-40°	-58	-51	-79	-32	+13	+49	+61	+63	+63	+65	+70	+79	+95	+116	+139	+172	+217	+237	+237	+237	+238	+207	+177	+37	+37
-50°	+45	+2	+9	+44	-5	+33	+154	+166	+151	+142	+135	+131	+128	+137	+154	+188	+237	+237	+237	+237	+238	+207	+177	+37	+37
-60°	+126	+90	+93	+114	+144	+177	+198	+205	+212	+212	+172	+161	+149	+147	+157	+179	+228	+237	+237	+237	+238	+207	+177	+37	+37
-70°	+162	+159	+149	+156	+196	+230	+217	+219	+212	+212	+172	+161	+149	+147	+157	+179	+228	+237	+237	+237	+238	+207	+177	+37	+37
-80°	+186	+182	+173	+184	+234	+271	+251	+251	+244	+244	+194	+184	+174	+163	+153	+176	+226	+237	+237	+237	+238	+207	+177	+37	+37

TABLE (42). Secular changes  $\Delta F$  of the ideal magnetism  $F_z$  between 1600-1650 when the time is increased by one year. GE of the 5th decimal. For  $\varphi=+30$ ,  $\Delta F=-0.00012$ ; for  $\varphi=+30$ ,  $\Delta F=-0.00006$ .

$\varphi$	A=0°	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°	195°	210°	225°	240°	255°	270°	285°	300°	315°	330°	345°
+80°	-6	-6	-8	-14	-18	-22	-30	-34	-34	-33	-30	-21	-14	-6	+2	+6	+10	+8	+4	+4	+4	+4	+4	+4
+70°	+2	+6	+10	+36	+42	+36	+18	-32	-50	-56	-44	-28	-10	+6	+20	+26	+26	+24	+20	+8	+2	-2	-6	-6
+60°	+4	+10	+36	+42	+36	+18	-32	-50	-56	-44	-28	-10	-4	+14	+24	+30	+30	+26	+14	+2	-16	-24	-30	-30
+50°	-2	+2	+10	+36	+42	+36	+18	-32	-50	-56	-44	-28	-4	+14	+24	+30	+30	+26	+14	+2	-16	-24	-30	-30
+40°	-20	+10	+36	+42	+36	+18	-32	-50	-56	-44	-28	-10	-4	+14	+24	+30	+30	+26	+14	+2	-16	-24	-30	-30
+30°	-30	+10	+36	+42	+36	+18	-32	-50	-56	-44	-28	-10	-4	+14	+24	+30	+30	+26	+14	+2	-16	-24	-30	-30
+20°	-36	+10	+36	+42	+36	+18	-32	-50	-56	-44	-28	-10	-4	+14	+24	+30	+30	+26	+14	+2	-16	-24	-30	-30
+10°	-48	+10	+36	+42	+36	+18	-32	-50	-56	-44	-28	-10	-4	+14	+24	+30	+30	+26	+14	+2	-16	-24	-30	-30
0°	-58	+10	+36	+42	+36	+18	-32	-50	-56	-44	-28	-10	-4	+14	+24	+30	+30	+26	+14	+2	-16	-24	-30	-30
-10°	-68	+10	+36	+42	+36	+18	-32	-50	-56	-44	-28	-10	-4	+14	+24	+30	+30	+26	+14	+2	-16	-24	-30	-30
-20°	-78	+10	+36	+42	+36	+18	-32	-50	-56	-44	-28	-10	-4	+14	+24	+30	+30	+26	+14	+2	-16	-24	-30	-30
-30°	-88	+10	+36	+42	+36	+18	-32	-50	-56	-44	-28	-10	-4	+14	+24	+30	+30	+26	+14	+2	-16	-24	-30	-30
-40°	-98	+10	+36	+42	+36	+18	-32	-50	-56	-44	-28	-10	-4	+14	+24	+30	+30	+26	+14	+2	-16	-24	-30	-30
-50°	-108	+10	+36	+42	+36	+18	-32	-50	-56	-44	-28	-10	-4	+14	+24	+30	+30	+26	+14	+2	-16	-24	-30	-30
-60°	-118	+10	+36	+42	+36	+18	-32	-50	-56	-44	-28	-10	-4	+14	+24	+30	+30	+26	+14	+2	-16	-24	-30	-30
-70°	-128	+10	+36	+42	+36	+18	-32	-50	-56	-44	-28	-10	-4	+14	+24	+30	+30	+26	+14	+2	-16	-24	-30	-30
-80°	-138	+10	+36	+42	+36	+18	-32	-50	-56	-44	-28	-10	-4	+14	+24	+30	+30	+26	+14	+2	-16	-24	-30	-30

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TABLE (42). Yearly secular changes  $\Delta F$  between 1650-1700. GE of the 5th decimal.  
For  $\phi = 90^\circ$ ,  $\lambda = 0^\circ$ ; for  $\phi = 90^\circ$ ,  $\lambda = 0^\circ$ .

$\phi$	$\lambda = 0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$
$+90^\circ$	+4	+4	+4	+4	+4	+4	+4	+4	+4	+4	+4	+4	+4	+4	+4	+4	+4	+4	+4	+4	+4	+4	+4	+4
$+70^\circ$	+8	+8	+8	+8	+8	+8	+8	+8	+8	+8	+8	+8	+8	+8	+8	+8	+8	+8	+8	+8	+8	+8	+8	+8
$+50^\circ$	+12	+12	+12	+12	+12	+12	+12	+12	+12	+12	+12	+12	+12	+12	+12	+12	+12	+12	+12	+12	+12	+12	+12	+12
$+30^\circ$	+16	+16	+16	+16	+16	+16	+16	+16	+16	+16	+16	+16	+16	+16	+16	+16	+16	+16	+16	+16	+16	+16	+16	+16
$+10^\circ$	+20	+20	+20	+20	+20	+20	+20	+20	+20	+20	+20	+20	+20	+20	+20	+20	+20	+20	+20	+20	+20	+20	+20	+20
$0^\circ$	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24
$-10^\circ$	+28	+28	+28	+28	+28	+28	+28	+28	+28	+28	+28	+28	+28	+28	+28	+28	+28	+28	+28	+28	+28	+28	+28	+28
$-30^\circ$	+32	+32	+32	+32	+32	+32	+32	+32	+32	+32	+32	+32	+32	+32	+32	+32	+32	+32	+32	+32	+32	+32	+32	+32
$-50^\circ$	+36	+36	+36	+36	+36	+36	+36	+36	+36	+36	+36	+36	+36	+36	+36	+36	+36	+36	+36	+36	+36	+36	+36	+36
$-70^\circ$	+40	+40	+40	+40	+40	+40	+40	+40	+40	+40	+40	+40	+40	+40	+40	+40	+40	+40	+40	+40	+40	+40	+40	+40
$-90^\circ$	+44	+44	+44	+44	+44	+44	+44	+44	+44	+44	+44	+44	+44	+44	+44	+44	+44	+44	+44	+44	+44	+44	+44	+44

TABLE (42). Yearly secular changes  $\Delta F$  between 1700-1780. GE of the 5th decimal.  
For  $\phi = 90^\circ$ ,  $\lambda = 0^\circ$ ; for  $\phi = 90^\circ$ ,  $\lambda = 0^\circ$ .

$\phi$	$\lambda = 0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$
$+90^\circ$	+4	+4	+4	+4	+4	+4	+4	+4	+4	+4	+4	+4	+4	+4	+4	+4	+4	+4	+4	+4	+4	+4	+4	+4
$+70^\circ$	+8	+8	+8	+8	+8	+8	+8	+8	+8	+8	+8	+8	+8	+8	+8	+8	+8	+8	+8	+8	+8	+8	+8	+8
$+50^\circ$	+12	+12	+12	+12	+12	+12	+12	+12	+12	+12	+12	+12	+12	+12	+12	+12	+12	+12	+12	+12	+12	+12	+12	+12
$+30^\circ$	+16	+16	+16	+16	+16	+16	+16	+16	+16	+16	+16	+16	+16	+16	+16	+16	+16	+16	+16	+16	+16	+16	+16	+16
$+10^\circ$	+20	+20	+20	+20	+20	+20	+20	+20	+20	+20	+20	+20	+20	+20	+20	+20	+20	+20	+20	+20	+20	+20	+20	+20
$0^\circ$	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24
$-10^\circ$	+28	+28	+28	+28	+28	+28	+28	+28	+28	+28	+28	+28	+28	+28	+28	+28	+28	+28	+28	+28	+28	+28	+28	+28
$-30^\circ$	+32	+32	+32	+32	+32	+32	+32	+32	+32	+32	+32	+32	+32	+32	+32	+32	+32	+32	+32	+32	+32	+32	+32	+32
$-50^\circ$	+36	+36	+36	+36	+36	+36	+36	+36	+36	+36	+36	+36	+36	+36	+36	+36	+36	+36	+36	+36	+36	+36	+36	+36
$-70^\circ$	+40	+40	+40	+40	+40	+40	+40	+40	+40	+40	+40	+40	+40	+40	+40	+40	+40	+40	+40	+40	+40	+40	+40	+40
$-90^\circ$	+44	+44	+44	+44	+44	+44	+44	+44	+44	+44	+44	+44	+44	+44	+44	+44	+44	+44	+44	+44	+44	+44	+44	+44

38

For  $\psi = +90^\circ$ ,  $\Delta \bar{F}_z = -0.00618$ ; for  $\psi = -90^\circ$ ,  $\Delta \bar{F}_z = +0.00317$ .

TABLE (42). Yearly secular changes  $\Delta F$  between 1842-1885. GE of the 5th decimal.

FOR  $\phi_0 = +90^\circ$ ,  $\Delta F = +0.00067$ , ; for  $\phi_0 = -90^\circ$ ,  $\Delta F = +0.00052$ .

49	A	0°	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°	195°	210°	225°	240°	255°	270°	285°	300°	315°	330°	345°
20°	+42	+40	+40	+40	+40	+37	+40	+42	+44	+47	+52	+56	+56	+56	+56	+58	+54	+52	+49	+49	+49	+44	+42	+42	+40
30°	+23	+21	+16	+14	+14	+14	+16	+16	+21	+25	+32	+39	+44	+49	+49	+49	+49	+49	+37	+37	+32	+32	+30	+28	+28
40°	+21	+9	-9	-12	-16	-16	-16	-16	-14	-4	+5	+21	+30	+40	+44	+44	+40	+37	+28	+28	+25	+28	+34	+35	+32
50°	+30	+7	-16	-32	-42	-44	-44	-44	-42	-32	-18	+2	+19	+25	+28	+28	+25	+21	+16	+16	+21	+28	+36	+35	+32
60°	+56	+21	-14	-40	-54	-58	-61	-61	-61	-54	-35	-12	+9	+21	+14	+12	+7	+2	+2	+2	+14	+37	+63	+77	+77
70°	+88	+49	+7	-30	-49	-63	-65	-65	-61	-61	-44	-21	+5	+19	+14	+5	-2	-12	-12	+5	+37	+75	+108	+107	+107
80°	+113	+75	+25	-21	-49	-56	-58	-58	-54	-56	-37	0	+25	+35	+25	+5	-5	-19	-16	-2	+32	+72	+105	+126	+126
90°	+131	+86	+35	-9	-37	-40	-39	-35	-35	-44	-31	-2	+25	+52	+49	+30	+12	-5	-14	-5	+23	+65	+112	+126	+126
0	+119	+21	+45	-2	-27	-14	+2	+2	+5	-9	-28	-25	+2	+40	+63	+45	+49	+25	-7	-7	+12	+59	+50	+119	+119
-10°	+110	+86	+47	+12	0	+14	+37	+47	+42	+32	+9	-3	+9	+32	+49	+54	+44	+30	-14	-14	-30	-72	+63	+102	+102
-20°	+95	+23	+52	+23	+19	+35	+54	+65	+54	+35	+16	+12	+12	+14	+16	+19	+16	+7	-16	-49	-75	-72	+23	+75	+75
-30°	+75	+75	+42	+32	+19	+38	+40	+44	+44	+42	+30	+14	-2	-12	-19	-21	-23	-28	-102	-131	-139	-139	-32	+35	+35
-40°	+40	+56	+47	+23	0	0	-14	-16	-12	-7	-5	-7	-12	-18	-40	-47	-54	-70	-131	-152	-158	-158	-83	-12	-12
-50°	+25	+23	+16	-9	-40	-61	-77	-77	-65	-45	-32	-13	-30	-30	-35	-40	-49	-75	-116	-163	-201	-207	-177	-112	-47
-60°	-25	-9	-16	-37	-67	-93	-112	-112	-100	-77	-54	-30	-30	-16	-9	-23	-47	-83	-152	-193	-196	-163	-104	-58	-58
-70°	-32	-30	-17	-52	-72	-88	-100	-100	-86	-65	-40	-19	-2	-12	-14	+4	-9	-32	-75	-75	-86	-81	-67	-59	-59
-80°	-23	-28	-30	-37	-44	-47	-49	-47	-40	-30	-19	-7	+5	+12	+16	+16	+9	+2	-7	-7	-1	-23	-25	-35	-35

λ	0°	15'	30'	45'	60'	75'	90°	105°	120°	135°	150°	165°	180°	195°	210°	225°	240°	255°	270°	285°	300°	315°	330°	345°
90°	+30	-6	-42	-76	-101	-124	-147	-170	-193	-216	-239	-262	-285	-308	-331	-354	-377	-400	-423	-446	-469	-492	-515	-538
80°	+30	-6	-42	-76	-101	-124	-147	-170	-193	-216	-239	-262	-285	-308	-331	-354	-377	-400	-423	-446	-469	-492	-515	-538
70°	+30	-6	-42	-76	-101	-124	-147	-170	-193	-216	-239	-262	-285	-308	-331	-354	-377	-400	-423	-446	-469	-492	-515	-538
60°	+30	-6	-42	-76	-101	-124	-147	-170	-193	-216	-239	-262	-285	-308	-331	-354	-377	-400	-423	-446	-469	-492	-515	-538
50°	+30	-6	-42	-76	-101	-124	-147	-170	-193	-216	-239	-262	-285	-308	-331	-354	-377	-400	-423	-446	-469	-492	-515	-538
40°	+30	-6	-42	-76	-101	-124	-147	-170	-193	-216	-239	-262	-285	-308	-331	-354	-377	-400	-423	-446	-469	-492	-515	-538
30°	+30	-6	-42	-76	-101	-124	-147	-170	-193	-216	-239	-262	-285	-308	-331	-354	-377	-400	-423	-446	-469	-492	-515	-538
20°	+30	-6	-42	-76	-101	-124	-147	-170	-193	-216	-239	-262	-285	-308	-331	-354	-377	-400	-423	-446	-469	-492	-515	-538
10°	+30	-6	-42	-76	-101	-124	-147	-170	-193	-216	-239	-262	-285	-308	-331	-354	-377	-400	-423	-446	-469	-492	-515	-538
0°	+30	-6	-42	-76	-101	-124	-147	-170	-193	-216	-239	-262	-285	-308	-331	-354	-377	-400	-423	-446	-469	-492	-515	-538

06	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82
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TABLE (43). Secular changes  $\Delta X$  between 1650-1700 when time is increased by one year.  
GE units of the 5th decimal

$\phi, \lambda = 0^\circ$	15°	10°	5°	0°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°	195°	210°	225°	240°	255°	270°	285°	300°	315°	330°	345°
+90°	+16	+44	+104	+150	+190	+228	+266	+306	+346	+386	+426	+466	+506	+546	+586	+626	+666	+706	+746	+786	+826	+866	+906	+946	+986	+1026
+80	+50	+104	+154	+204	+254	+304	+354	+404	+454	+504	+554	+604	+654	+704	+754	+804	+854	+904	+954	+1004	+1054	+1104	+1154	+1204	+1254	+1304
+70	+100	+186	+272	+358	+444	+530	+616	+702	+788	+874	+960	+1046	+1132	+1218	+1304	+1390	+1476	+1562	+1648	+1734	+1820	+1906	+1992	+2078	+2164	+2250
+60	+114	+254	+348	+442	+536	+630	+724	+818	+912	+1006	+1100	+1194	+1288	+1382	+1476	+1570	+1664	+1758	+1852	+1946	+2040	+2134	+2228	+2322	+2416	+2510
+50	+56	+260	+354	+448	+542	+636	+730	+824	+918	+1012	+1106	+1200	+1294	+1388	+1482	+1576	+1670	+1764	+1858	+1952	+2046	+2140	+2234	+2328	+2422	+2516
+40	+48	+196	+290	+384	+478	+572	+666	+760	+854	+948	+1042	+1136	+1230	+1324	+1418	+1512	+1606	+1700	+1794	+1888	+1982	+2076	+2170	+2264	+2358	+2452
+30	+120	+20	+354	+448	+542	+636	+730	+824	+918	+1012	+1106	+1200	+1294	+1388	+1482	+1576	+1670	+1764	+1858	+1952	+2046	+2140	+2234	+2328	+2422	+2516
+20	+140	+30	+310	+404	+498	+592	+686	+780	+874	+968	+1062	+1156	+1250	+1344	+1438	+1532	+1626	+1720	+1814	+1908	+2002	+2096	+2190	+2284	+2378	+2472
+10	+100	+40	+350	+444	+538	+632	+726	+820	+914	+1008	+1102	+1196	+1290	+1384	+1478	+1572	+1666	+1760	+1854	+1948	+2042	+2136	+2230	+2324	+2418	+2512
0	+84	+50	+30	+20	+10	+0	+10	+20	+30	+40	+50	+60	+70	+80	+90	+100	+110	+120	+130	+140	+150	+160	+170	+180	+190	+200
-10	+28	+64	+174	+268	+362	+456	+550	+644	+738	+832	+926	+1020	+1114	+1208	+1302	+1396	+1490	+1584	+1678	+1772	+1866	+1960	+2054	+2148	+2242	+2336
-20	+12	+12	+108	+202	+296	+390	+484	+578	+672	+766	+860	+954	+1048	+1142	+1236	+1330	+1424	+1518	+1612	+1706	+1800	+1894	+1988	+2082	+2176	+2270
-30	+40	+78	+152	+246	+340	+434	+528	+622	+716	+810	+904	+998	+1092	+1186	+1280	+1374	+1468	+1562	+1656	+1750	+1844	+1938	+2032	+2126	+2220	+2314
-40	+56	+84	+136	+230	+324	+418	+512	+606	+700	+794	+888	+982	+1076	+1170	+1264	+1358	+1452	+1546	+1640	+1734	+1828	+1922	+2016	+2110	+2204	+2298
-50	+72	+100	+164	+258	+352	+446	+540	+634	+728	+822	+916	+1010	+1104	+1198	+1292	+1386	+1480	+1574	+1668	+1762	+1856	+1950	+2044	+2138	+2232	+2326
-60	+88	+116	+180	+274	+368	+462	+556	+650	+744	+838	+932	+1026	+1120	+1214	+1308	+1402	+1496	+1590	+1684	+1778	+1872	+1966	+2060	+2154	+2248	+2342
-70	+104	+132	+196	+290	+384	+478	+572	+666	+760	+854	+948	+1042	+1136	+1230	+1324	+1418	+1512	+1606	+1700	+1794	+1888	+1982	+2076	+2170	+2264	+2358
-80	+120	+148	+212	+306	+400	+494	+588	+682	+776	+870	+964	+1058	+1152	+1246	+1340	+1434	+1528	+1622	+1716	+1810	+1904	+1998	+2092	+2186	+2280	+2374
-90	+136	+164	+228	+322	+416	+510	+604	+698	+792	+886	+980	+1074	+1168	+1262	+1356	+1450	+1544	+1638	+1732	+1826	+1920	+2014	+2108	+2202	+2296	+2390

TABLE (43). Secular changes  $\Delta X$  between 1700-1780 when time is increased by one year.  
GE units of the 5th decimal

$\phi, \lambda = 0^\circ$	15°	10°	5°	0°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°	195°	210°	225°	240°	255°	270°	285°	300°	315°	330°	345°
+90°	+16	+44	+104	+150	+190	+228	+266	+306	+346	+386	+426	+466	+506	+546	+586	+626	+666	+706	+746	+786	+826	+866	+906	+946	+986	+1026
+80	+50	+104	+154	+204	+254	+304	+354	+404	+454	+504	+554	+604	+654	+704	+754	+804	+854	+904	+954	+1004	+1054	+1104	+1154	+1204	+1254	+1304
+70	+100	+186	+272	+358	+444	+530	+616	+702	+788	+874	+960	+1046	+1132	+1218	+1304	+1390	+1476	+1562	+1648	+1734	+1820	+1906	+1992	+2078	+2164	+2250
+60	+114	+254	+348	+442	+536	+630	+724	+818	+912	+1006	+1100	+1194	+1288	+1382	+1476	+1570	+1664	+1758	+1852	+1946	+2040	+2134	+2228	+2322	+2416	+2510
+50	+56	+260	+354	+448	+542	+636	+730	+824	+918	+1012	+1106	+1200	+1294	+1388	+1482	+1576	+1670	+1764	+1858	+1952	+2046	+2140	+2234	+2328	+2422	+2516
+40	+48	+196	+290	+384	+478	+572	+666	+760	+854	+948	+1042	+1136	+1230	+1324	+1418	+1512	+1606	+1700	+1794	+1888	+1982	+2076	+2170	+2264	+2358	+2452
+30	+120	+20	+354	+448	+542	+636	+730	+824	+918	+1012	+1106	+1200	+1294	+1388	+1482	+1576	+1670	+1764	+1858	+1952	+2046	+2140	+2234	+2328	+2422	+2516
+20	+140	+30	+310	+404	+498	+592	+686	+780	+874	+968	+1062	+1156	+1250	+1344	+1438	+1532	+1626	+1720	+1814	+1908	+2002	+2096	+2190	+2284	+2378	+2472
+10	+100	+40	+350	+444	+538	+632	+726	+820	+914	+1008	+1102	+1196	+1290	+1384	+1478	+1572	+1666	+1760	+1854	+1948	+2042	+2136	+2230	+2324	+2418	+2512
0	+84	+50	+30	+20	+10	+0	+10	+20	+30	+40	+50	+60	+70	+80	+90	+100	+110	+120	+130	+140	+150	+160	+170	+180	+190	+200
-10	+28	+64	+174	+268	+362	+456	+550	+644	+738	+832	+926	+1020	+1114	+1208	+1302	+1396	+1490	+1584	+1678	+1772	+1866	+1960	+2054	+2148	+2242	+2336
-20	+12	+12	+108	+202	+296	+390	+484	+578	+672	+766	+860	+954	+1048	+1142	+1236	+1330	+1424	+1518	+1612	+1706	+1800	+1894	+1988	+2082	+2176	+2270
-30	+40	+78	+152	+246	+340	+434	+528	+622	+716	+810	+904	+998	+1092	+1186	+1280	+1374	+1468	+1562	+1656	+1750	+1844	+1938	+2032	+2126	+2220	+2314
-40	+56	+84	+136	+230	+324	+418	+512	+606	+700	+794	+888	+982	+1076	+1170	+1264	+1358	+1452	+1546	+1640	+1734	+1828	+1922	+2016	+2110	+2204	+2298
-50	+72	+100	+164	+258	+352	+446	+540	+634	+728	+822	+916	+1010	+1104	+1198	+1292	+1386	+1480	+1574	+1668	+1762	+1856	+1950	+2044	+2138	+2232	+2326
-60	+88	+116	+180	+274	+368	+462	+556	+650	+744	+838	+932	+1026	+1120	+1214	+1308	+1402	+1496	+1590	+1684	+1778	+1872	+1966	+2060	+2154	+2248	+2342
-70	+104	+132	+196	+290	+384	+478	+572	+666	+760	+854	+948	+1042	+1136	+1230	+1324	+1418	+1512	+1606	+1700	+1794	+1888	+1982	+2076	+2170	+2264	+2358
-80	+120	+148	+212	+306	+400	+494	+588	+682	+776	+870	+964	+1058	+1152	+1246	+1340	+1434	+1528	+1622	+1716	+1810	+1904	+1998	+2092	+2186	+2280	+2374
-90	+136	+164	+228	+322	+416	+510	+604	+698	+792	+886	+980	+1074	+1168	+1262	+1356	+1450	+1544	+1638	+1732	+1826	+1920	+2014	+2108	+2202	+2296	+2390

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TABLE (43). Secular changes  $\Delta X$  between 1780-1842 when time is increased by one year.  
GE units of the 5th decimal

$\varphi$	$\lambda = 0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$	
+30°	-144	-103	-56	-6	+45	+94	+133	+167	+188	+196	+191	+172	+144	+103	+54	+6	+45	-34	-135	-167	-188	-196	-191	-172	-144
+20°	-87	+31	+79	+110	+121	+119	+111	+103	+102	+106	+121	+144	+166	+179	+169	+135	+76	0	-77	-135	-167	-188	-196	-191	-172
+10°	+116	+153	+158	+135	+84	+27	-21	-53	-68	-65	-42	-182	-139	-73	+5	+61	+139	+63	-31	-55	-31	+23	+105	+195	+285
0°	+358	+366	+352	+300	+214	+94	-31	-126	-181	-248	-314	-342	-344	-306	-237	-155	-100	-32	-73	-43	+125	+234	+328	+405	
+10°	+575	+572	+509	+408	+263	+137	+63	-23	-63	-104	-134	-162	-178	-144	-95	-41	-25	-160	-102	-26	+45	+111	+212	+337	
+20°	+532	+550	+532	+477	+377	+243	+126	+53	+19	+87	+34	+34	+34	+34	+34	+34	+34	+34	+34	+34	+34	+34	+34	+34	
+30°	+500	+537	+508	+423	+303	+177	+84	+21	+11	-18	-39	-53	-76	-123	-185	-285	-304	-160	-94	-47	-21	+3	+115	+311	
+40°	+408	+447	+422	+337	+217	+134	+58	+21	+11	+18	+47	+118	+105	+111	+102	+66	+5	-60	-83	-31	-110	-172	-203	-144	
+50°	-33	+6	+37	+71	+133	+207	+266	+304	+298	+246	+177	+95	+38	+21	+37	+22	+16	+73	+11	-102	-223	-236	-264	-328	
+60°	-382	-373	-358	-345	-324	-294	-250	-201	-145	-88	-31	+31	+138	+298	+492	+746	+990	+1244	+1508	+1782	+2066	+2360	+2664	+2978	
+70°	-623	-631	-644	-661	-684	-712	-745	-783	-826	-874	-926	-982	-1042	-1106	-1174	-1246	-1322	-1402	-1486	-1574	-1666	-1762	-1862	-1966	
+80°	-860	-877	-894	-921	-948	-975	-1002	-1029	-1056	-1083	-1110	-1137	-1164	-1191	-1218	-1245	-1272	-1300	-1327	-1354	-1381	-1408	-1435	-1462	
+90°	-1100	-1127	-1154	-1181	-1208	-1235	-1262	-1289	-1316	-1343	-1370	-1397	-1424	-1451	-1478	-1505	-1532	-1559	-1586	-1613	-1640	-1667	-1694	-1721	

TABLE (43). Secular changes  $\Delta X$  between 1842-1885 when time is increased by one year.  
GE units of the 5th decimal

$\lambda$	0°	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°	195°	210°	225°	240°	255°	270°	285°	300°	315°	330°	345°
+30°	-219	-273	-311	-323	-316	-287	-239	-174	-95	-14	-70	-151	-218	-271	-311	-333	-346	-357	-367	-374	-375	-374	-371	-365
+20°	-49	-97	-147	-201	-234	-262	-286	-306	-324	-340	-356	-371	-387	-402	-417	-431	-445	-459	-473	-487	-499	-510	-520	-529
+10°	0	-83	-170	-244	-300	-336	-360	-378	-390	-402	-414	-426	-438	-450	-462	-474	-486	-498	-510	-522	-534	-546	-558	-569
0°	+112	0	-121	-224	-300	-355	-383	-398	-408	-414	-420	-426	-432	-438	-444	-450	-456	-462	-468	-474	-480	-486	-492	-498
+50°	+237	+133	+2	-119	-207	-260	-290	-306	-317	-325	-331	-337	-343	-349	-355	-361	-367	-373	-379	-385	-391	-397	-403	-409
+40°	+302	+224	+165	+93	-38	-133	-161	-174	-184	-186	-186	-186	-186	-186	-186	-186	-186	-186	-186	-186	-186	-186	-186	-186
+30°	+264	+241	+191	+131	+63	+9	-2	0	-76	-123	-133	-133	-133	-133	-133	-133	-133	-133	-133	-133	-133	-133	-133	-133
+20°	+154	+179	+151	+100	+43	+107	+147	+147	+147	+147	+147	+147	+147	+147	+147	+147	+147	+147	+147	+147	+147	+147	+147	+147
+10°	0	+67	+100	+119	+119	+119	+119	+119	+119	+119	+119	+119	+119	+119	+119	+119	+119	+119	+119	+119	+119	+119	+119	+119
0°	-142	-58	+23	+83	+102	+184	+271	+323	+339	+343	+343	+343	+343	+343	+343	+343	+343	+343	+343	+343	+343	+343	+343	+343
-10°	-204	-142	-25	+28	+166	+212	+226	+226	+226	+226	+226	+226	+226	+226	+226	+226	+226	+226	+226	+226	+226	+226	+226	+226
-20°	-380	-284	-90	0	+35	+16	-16	-34	-52	-72	-92	-112	-132	-152	-172	-192	-212	-232	-252	-272	-292	-312	-332	-352
-30°	-483	-383	-209	-144	-63	-24	-32	-32	-32	-32	-32	-32	-32	-32	-32	-32	-32	-32	-32	-32	-32	-32	-32	-32
-40°	-549	-440	-371	-323	-364	-427	-504	-585	-671	-762	-858	-959	-1064	-1174	-1288	-1406	-1528	-1654	-1784	-1918	-2056	-2198	-2344	-2494
-50°	-599	-476	-409	-371	-423	-490	-568	-649	-734	-824	-919	-1019	-1124	-1234	-1348	-1466	-1588	-1714	-1844	-1978	-2116	-2258	-2404	-2554
-60°	-662	-539	-471	-431	-484	-551	-629	-710	-794	-884	-979	-1079	-1184	-1294	-1408	-1526	-1648	-1774	-1904	-2038	-2176	-2318	-2464	-2614
-70°	-733	-610	-541	-501	-554	-621	-699	-780	-864	-954	-1054	-1154	-1254	-1354	-1454	-1554	-1654	-1754	-1854	-1954	-2054	-2154	-2254	-2354
-80°	-810	-687	-618	-578	-631	-698	-776	-857	-941	-1031	-1121	-1211	-1301	-1391	-1481	-1571	-1661	-1751	-1841	-1931	-2021	-2111	-2201	-2291
-90°	-894	-771	-702	-662	-715	-782	-860	-941	-1026	-1116	-1206	-1296	-1386	-1476	-1566	-1656	-1746	-1836	-1926	-2016	-2106	-2196	-2286	-2376



TABLE (44). Secular changes  $\Delta\gamma$  between 1550-1600 when time is increased by one year.  
Gauss units of the 5th decimal

$\phi$	$\lambda = 0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$	
+90	-135	-140	-131	-118	-94	-66	-38	-6	+42	+76	+102	+124	+138	+140	+132	+118	+94	+66	+38	+8	-42	-76	-102	-131	-145
+80	-24	-29	-38	-47	-52	-54	-52	-44	-36	-26	-14	+6	+20	+23	+24	+20	+13	+6	-4	-10	-17	-24	-31	-38	-44
+70	+50	+113	+86	+70	-96	-130	-152	-164	-166	-156	-134	-104	-84	-64	-44	-24	-10	+6	+20	+23	+24	+20	+13	+6	-4
+60	+174	+231	+218	+196	-54	-204	-298	-338	-352	-344	-314	-274	-224	-174	-124	-74	-24	+6	+20	+23	+24	+20	+13	+6	-4
+50	+226	+320	+313	+284	-24	-200	-331	-371	-386	-378	-348	-308	-258	-208	-158	-108	-58	+2	+26	+29	+30	+26	+19	+12	+6
+40	+280	+378	+370	+338	+86	-134	-332	-372	-387	-379	-349	-309	-259	-209	-159	-109	-59	+6	+30	+33	+34	+30	+23	+16	+10
+30	+328	+412	+404	+368	+124	-166	-368	-408	-423	-415	-385	-345	-295	-245	-195	-145	-95	+14	+38	+41	+42	+38	+31	+24	+18
+20	+372	+440	+432	+396	+174	-180	-384	-424	-439	-431	-401	-361	-311	-261	-211	-161	-111	+22	+42	+45	+46	+42	+35	+28	+22
+10	+412	+468	+460	+424	+204	-212	-416	-456	-471	-463	-433	-393	-343	-293	-243	-193	-143	+30	+46	+49	+50	+46	+39	+32	+26
0	+452	+508	+500	+464	+244	-252	-456	-496	-511	-503	-473	-433	-383	-333	-283	-233	-183	+38	+50	+53	+54	+50	+43	+36	+30
-10	+492	+548	+540	+504	+284	-304	-508	-548	-563	-555	-525	-485	-435	-385	-335	-285	-235	+46	+54	+57	+58	+54	+47	+40	+34
-20	+532	+588	+580	+544	+324	-344	-548	-588	-603	-595	-565	-525	-475	-425	-375	-325	-275	+54	+60	+63	+64	+60	+53	+46	+40
-30	+572	+628	+620	+584	+364	-384	-588	-628	-643	-635	-605	-565	-515	-465	-415	-365	-315	+62	+66	+69	+70	+66	+59	+52	+46
-40	+612	+668	+660	+624	+404	-424	-628	-668	-683	-675	-645	-605	-555	-505	-455	-405	-355	+70	+72	+75	+76	+72	+65	+58	+52
-50	+652	+708	+700	+664	+444	-464	-668	-708	-723	-715	-685	-645	-595	-545	-495	-445	-395	+78	+78	+81	+82	+78	+71	+64	+58
-60	+692	+748	+740	+704	+484	-504	-708	-748	-763	-755	-725	-685	-635	-585	-535	-485	-435	+86	+84	+87	+88	+84	+77	+70	+64
-70	+732	+788	+780	+744	+524	-544	-748	-788	-803	-795	-765	-725	-675	-625	-575	-525	-475	+94	+90	+93	+94	+90	+83	+76	+70
-80	+772	+828	+820	+784	+564	-584	-788	-828	-843	-835	-805	-765	-715	-665	-615	-565	-515	+102	+96	+99	+100	+96	+89	+82	+76
-90	+812	+868	+860	+824	+604	-624	-828	-868	-883	-875	-845	-805	-755	-705	-655	-605	-555	+110	+102	+105	+106	+102	+95	+88	+82

TABLE (44). Secular changes  $\Delta\gamma$  between 1600-1650 when time is increased by one year.  
Gauss units of the 5th decimal

$\phi$	$\lambda = 0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$
+90	-46	-54	-60	-58	-56	-48	-38	-24	-10	+6	+22	+34	+46	+54	+60	+68	+76	+82	+88	+94	+100	+106	+112	+118
+80	+92	+68	+30	-48	-112	-162	-168	-134	-63	+12	+32	+44	+56	+66	+74	+82	+90	+96	+102	+108	+114	+120	+126	+132
+70	+224	+202	+122	+2	-132	-244	-292	-238	-136	+16	+46	+58	+68	+76	+84	+92	+100	+106	+112	+118	+124	+130	+136	+142
+60	+384	+328	+252	+102	-102	-244	-372	-322	-172	-6	+26	+56	+68	+76	+84	+92	+100	+106	+112	+118	+124	+130	+136	+142
+50	+574	+406	+372	+212	-50	-300	+46	-346	-206	-24	+102	+162	+134	+38	-56	-112	-114	-96	-136	-180	-200	-134	+12	+176
+40	+388	+450	+440	+288	-14	-196	-472	-336	-180	-36	+118	+162	+104	-6	-132	-228	-156	-116	-152	-196	-256	+8	+192	+118
+30	+390	+470	+494	+326	-74	-314	-392	-274	-130	-58	+2	+104	+172	+176	-186	-278	-214	-144	-168	-170	-154	+8	+186	+314
+20	+390	+472	+496	+328	-46	-314	-354	-182	-50	-50	+40	+76	+162	+44	-238	-378	-286	-98	-58	-150	-178	-26	+198	+320
+10	+394	+494	+492	+280	-96	-316	-332	-96	+36	-32	+76	+50	+192	+94	-232	-346	-328	-84	-44	-140	-204	-52	+182	+318
0	+400	+498	+490	+232	-132	-308	-320	-36	+112	+4	+94	+8	+176	+92	-234	-354	-352	-56	+4	-132	-230	-72	+202	+168
-10	+422	+476	+372	+202	-168	-358	-302	+6	+160	+42	+102	-42	-30	+44	-224	-390	-252	+2	+98	-162	-280	-110	+204	+396
-20	+446	+472	+368	+194	-198	-334	-266	+10	+152	+50	+116	-132	-30	+44	-204	-278	-142	+38	+2	-82	-322	-118	+204	+428
-30	+482	+438	+170	+100	-58	-270	-232	-78	+122	+40	-162	-202	-152	-138	-170	-152	-30	+58	+52	-382	-354	-136	+218	+466
-40	+508	+468	+382	+220	-10	-238	-192	-54	+122	+50	-172	-244	-232	-184	-126	-60	+52	+58	+52	-338	-362	-136	+206	+454
-50	+518	+434	+400	+244	+30	-192	-176	-74	-22	-56	-152	-226	-234	-174	-92	0	+42	-30	-204	-366	-338	-132	+180	+426
-60	+480	+432	+408	+278	+110	-18	-92	-96	-82	-106	-162	-208	-204	-148	-74	-18	-22	-106	-340	-326	-326	-98	+154	+372
-70	+396	+422	+378	+276	+158	+40	-32	-36	-108	-108	-150	-172	-172	-110	-94	-84	-110	-172	-236	-356	-394	-60	+126	+290
-80	+292	+344	+332	+262	+196	+110	+36	-74	-78	-108	-120	-128	-160	-148	-152	-164	-180	-190	-188	-158	-94	+112	+216	+162
-90	+200	+222	+312	+228	+282	+164	+110	+62	+2	-56	-114	-162	-200	-222	-232	-224	-202	-166	-118	-62	-450	+114	+162	+162

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TABLE (44) Secular changes  $\Delta\gamma$  between 1650-1700 when time is increased by one year.  
Gauss units of the 5th decimal

$\lambda = 0^\circ$	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°	195°	210°	225°	240°	255°	270°	285°	300°	315°	330°	345°	
+90°	+229	+226	+206	+172	+130	+76	+16	-44	-100	-150	-196	-232	-266	-290	-306	-310	-306	-296	-276	-244	+100	+150	+196	+226
+80	+234	+190	+138	+90	+52	+30	+12	-10	-36	-74	-126	-186	-234	-266	-290	-306	-310	-296	-276	-244	+168	+222	+259	+284
+70	+261	+192	+102	+5	-20	-70	-120	-174	-222	-266	-306	-342	-374	-400	-418	-426	-422	-406	-380	-344	+176	+236	+284	+304
+60	+334	+266	+118	-66	-192	-210	-116	+2	+76	+82	+34	-46	-158	-274	-350	-386	-398	-374	-340	-294	+234	+310	+342	+362
+50	+428	+390	+186	-112	-342	-366	-210	-36	+50	+114	+114	+62	-60	-214	-366	-408	-422	-394	-350	-294	+252	+336	+370	+388
+40	+534	+534	+318	-114	-470	-518	-308	-70	+58	+114	+174	+106	+66	-166	-374	-446	-452	-422	-374	-314	+230	+352	+382	+412
+30	+598	+576	+436	-86	-572	-616	-366	-100	+22	+90	+176	+106	+70	-156	-366	-438	-442	-412	-360	-290	+190	+366	+404	+448
+20	+616	+582	+452	-136	-576	-672	-400	-134	+34	+44	+216	+130	+234	-110	-344	-432	-436	-406	-354	-284	+176	+382	+416	+454
+10	+658	+600	+466	-188	-574	-660	-394	-134	+52	+72	+172	+134	+210	-148	-376	-476	-476	-446	-394	-324	+140	+404	+436	+476
0	+698	+628	+486	-238	-568	-654	-408	-188	+52	+72	+182	+134	+214	-186	-412	-512	-512	-482	-430	-360	+140	+404	+436	+476
-10	+638	+584	+444	-184	-548	-634	-384	-184	+52	+72	+182	+134	+214	-186	-412	-512	-512	-482	-430	-360	+140	+404	+436	+476
-20	+618	+540	+376	-140	-528	-614	-364	-164	+52	+72	+182	+134	+214	-186	-412	-512	-512	-482	-430	-360	+140	+404	+436	+476
-30	+618	+666	+524	+168	-164	-352	-134	-20	-56	-168	-218	-316	-326	-324	-268	-264	-264	-234	-200	-160	+136	+408	+508	+552
-40	+600	+590	+478	+218	-34	-110	-50	-56	-168	-218	-310	-316	-312	-312	-248	-254	-254	-224	-180	-140	+186	+366	+450	+546
-50	+572	+556	+450	+268	+108	+24	+30	-64	-212	-342	-352	-364	-368	-368	-276	-332	-332	-302	-260	-220	+186	+366	+450	+546
-60	+554	+532	+452	+394	+212	+136	+28	-76	-212	-332	-352	-364	-368	-368	-276	-332	-332	-302	-260	-220	+186	+366	+450	+546
-70	+520	+500	+472	+500	+304	+222	+130	-88	-210	-328	-352	-364	-368	-368	-276	-332	-332	-302	-260	-220	+186	+366	+450	+546
-80	+494	+474	+446	+432	+252	+162	+150	-88	-204	-302	-326	-340	-344	-344	-276	-332	-332	-302	-260	-220	+186	+366	+450	+546
-90	+444	+428	+402	+444	+290	+180	+58	-68	-140	-252	-282	-312	-342	-372	-402	-432	-462	-492	-522	-552	+68	+120	+220	+324

TABLE (44) Secular changes  $\Delta\gamma$  between 1700-1780 when time is increased by one year.  
Gauss units of the 5th decimal

$\lambda = 0^\circ$	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°	195°	210°	225°	240°	255°	270°	285°	300°	315°	330°	345°	
+90°	+11	-59	-124	-180	-235	-284	-324	-364	-404	-442	-479	-514	-549	-584	-614	-644	-674	-704	-734	-764	+196	+234	+266	+294
+80	+126	+7	-127	-150	-208	-258	-308	-358	-408	-458	-508	-558	-608	-658	-708	-758	-808	-858	-908	-958	+234	+272	+304	+332
+70	+254	+107	-85	-268	-359	-439	-519	-599	-679	-759	-839	-919	-999	-1079	-1159	-1239	-1319	-1399	-1479	-1559	+272	+310	+342	+370
+60	+361	+194	-29	-478	-579	-679	-779	-879	-979	-1079	-1179	-1279	-1379	-1479	-1579	-1679	-1779	-1879	-1979	-2079	+310	+342	+374	+406
+50	+455	+275	+37	-210	-391	-491	-591	-691	-791	-891	-991	-1091	-1191	-1291	-1391	-1491	-1591	-1691	-1791	-1891	+342	+374	+406	+438
+40	+520	+324	+84	-169	-356	-456	-556	-656	-756	-856	-956	-1056	-1156	-1256	-1356	-1456	-1556	-1656	-1756	-1856	+374	+406	+438	+470
+30	+594	+374	+178	-135	-322	-422	-522	-622	-722	-822	-922	-1022	-1122	-1222	-1322	-1422	-1522	-1622	-1722	-1822	+406	+438	+470	+502
+20	+594	+414	+186	-111	-336	-436	-536	-636	-736	-836	-936	-1036	-1136	-1236	-1336	-1436	-1536	-1636	-1736	-1836	+438	+470	+502	+534
+10	+572	+448	+230	-26	-362	-462	-562	-662	-762	-862	-962	-1062	-1162	-1262	-1362	-1462	-1562	-1662	-1762	-1862	+470	+502	+534	+566
0	+572	+448	+230	-26	-362	-462	-562	-662	-762	-862	-962	-1062	-1162	-1262	-1362	-1462	-1562	-1662	-1762	-1862	+502	+534	+566	+598
-10	+562	+442	+222	-31	-371	-471	-571	-671	-771	-871	-971	-1071	-1171	-1271	-1371	-1471	-1571	-1671	-1771	-1871	+534	+566	+598	+630
-20	+592	+452	+324	+23	-185	-286	-388	-488	-588	-688	-788	-888	-988	-1088	-1188	-1288	-1388	-1488	-1588	-1688	+566	+598	+630	+662
-30	+594	+456	+336	+85	-21	-111	-141	-171	-271	-371	-471	-571	-671	-771	-871	-971	-1071	-1171	-1271	-1371	+598	+630	+662	+694
-40	+599	+459	+339	+161	+55	+16	-30	-104	-152	-202	-252	-302	-352	-402	-452	-502	-552	-602	-652	-702	+630	+662	+694	+726
-50	+599	+459	+339	+161	+55	+16	-30	-104	-152	-202	-252	-302	-352	-402	-452	-502	-552	-602	-652	-702	+662	+694	+726	+758
-60	+599	+459	+339	+161	+55	+16	-30	-104	-152	-202	-252	-302	-352	-402	-452	-502	-552	-602	-652	-702	+694	+726	+758	+790
-70	+599	+459	+339	+161	+55	+16	-30	-104	-152	-202	-252	-302	-352	-402	-452	-502	-552	-602	-652	-702	+726	+758	+790	+822
-80	+599	+459	+339	+161	+55	+16	-30	-104	-152	-202	-252	-302	-352	-402	-452	-502	-552	-602	-652	-702	+758	+790	+822	+854
-90	+599	+459	+339	+161	+55	+16	-30	-104	-152	-202	-252	-302	-352	-402	-452	-502	-552	-602	-652	-702	+790	+822	+854	+886

TABLE (44) Secular changes  $\Delta y$  between 1780-1842 when time is increased by one year.  
Gauss units of the 5th decimal

$\lambda = 0^\circ$	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°	195°	210°	225°	240°	255°	270°	285°	300°	315°	330°	345°
+20°	+105	+167	+188	+196	+198	+194	+183	+166	+146	+126	+106	+86	+66	+46	+26	+6	-14	-34	-54	-74	-94	-114	-134
+30°	+204	+266	+287	+294	+296	+292	+281	+264	+244	+224	+204	+184	+164	+144	+124	+104	+84	+64	+44	+24	+4	-16	-36
+40°	+285	+347	+368	+375	+377	+373	+362	+345	+325	+305	+285	+265	+245	+225	+205	+185	+165	+145	+125	+105	+85	+65	+45
+50°	+346	+408	+429	+436	+438	+434	+423	+406	+386	+366	+346	+326	+306	+286	+266	+246	+226	+206	+186	+166	+146	+126	+106
+60°	+387	+449	+470	+477	+479	+475	+464	+447	+427	+407	+387	+367	+347	+327	+307	+287	+267	+247	+227	+207	+187	+167	+147
+70°	+408	+470	+491	+498	+500	+496	+485	+468	+448	+428	+408	+388	+368	+348	+328	+308	+288	+268	+248	+228	+208	+188	+168
+80°	+409	+471	+492	+499	+501	+497	+486	+469	+449	+429	+409	+389	+369	+349	+329	+309	+289	+269	+249	+229	+209	+189	+169
+90°	+410	+472	+493	+500	+502	+498	+487	+470	+450	+430	+410	+390	+370	+350	+330	+310	+290	+270	+250	+230	+210	+190	+170
+100°	+411	+473	+494	+501	+503	+499	+488	+471	+451	+431	+411	+391	+371	+351	+331	+311	+291	+271	+251	+231	+211	+191	+171
+110°	+412	+474	+495	+502	+504	+500	+489	+472	+452	+432	+412	+392	+372	+352	+332	+312	+292	+272	+252	+232	+212	+192	+172
+120°	+413	+475	+496	+503	+505	+501	+490	+473	+453	+433	+413	+393	+373	+353	+333	+313	+293	+273	+253	+233	+213	+193	+173
+130°	+414	+476	+497	+504	+506	+502	+491	+474	+454	+434	+414	+394	+374	+354	+334	+314	+294	+274	+254	+234	+214	+194	+174
+140°	+415	+477	+498	+505	+507	+503	+492	+475	+455	+435	+415	+395	+375	+355	+335	+315	+295	+275	+255	+235	+215	+195	+175
+150°	+416	+478	+499	+506	+508	+504	+493	+476	+456	+436	+416	+396	+376	+356	+336	+316	+296	+276	+256	+236	+216	+196	+176
+160°	+417	+479	+500	+507	+509	+505	+494	+477	+457	+437	+417	+397	+377	+357	+337	+317	+297	+277	+257	+237	+217	+197	+177
+170°	+418	+480	+501	+508	+510	+506	+495	+478	+458	+438	+418	+398	+378	+358	+338	+318	+298	+278	+258	+238	+218	+198	+178
+180°	+419	+481	+502	+509	+511	+507	+496	+479	+459	+439	+419	+399	+379	+359	+339	+319	+299	+279	+259	+239	+219	+199	+179
+190°	+420	+482	+503	+510	+512	+508	+497	+480	+460	+440	+420	+400	+380	+360	+340	+320	+300	+280	+260	+240	+220	+200	+180
+200°	+421	+483	+504	+511	+513	+509	+498	+481	+461	+441	+421	+401	+381	+361	+341	+321	+301	+281	+261	+241	+221	+201	+181
+210°	+422	+484	+505	+512	+514	+510	+499	+482	+462	+442	+422	+402	+382	+362	+342	+322	+302	+282	+262	+242	+222	+202	+182
+220°	+423	+485	+506	+513	+515	+511	+500	+483	+463	+443	+423	+403	+383	+363	+343	+323	+303	+283	+263	+243	+223	+203	+183
+230°	+424	+486	+507	+514	+516	+512	+501	+484	+464	+444	+424	+404	+384	+364	+344	+324	+304	+284	+264	+244	+224	+204	+184
+240°	+425	+487	+508	+515	+517	+513	+502	+485	+465	+445	+425	+405	+385	+365	+345	+325	+305	+285	+265	+245	+225	+205	+185
+250°	+426	+488	+509	+516	+518	+514	+503	+486	+466	+446	+426	+406	+386	+366	+346	+326	+306	+286	+266	+246	+226	+206	+186
+260°	+427	+489	+510	+517	+519	+515	+504	+487	+467	+447	+427	+407	+387	+367	+347	+327	+307	+287	+267	+247	+227	+207	+187
+270°	+428	+490	+511	+518	+520	+516	+505	+488	+468	+448	+428	+408	+388	+368	+348	+328	+308	+288	+268	+248	+228	+208	+188
+280°	+429	+491	+512	+519	+521	+517	+506	+489	+469	+449	+429	+409	+389	+369	+349	+329	+309	+289	+269	+249	+229	+209	+189
+290°	+430	+492	+513	+520	+522	+518	+507	+490	+470	+450	+430	+410	+390	+370	+350	+330	+310	+290	+270	+250	+230	+210	+190
+300°	+431	+493	+514	+521	+523	+519	+508	+491	+471	+451	+431	+411	+391	+371	+351	+331	+311	+291	+271	+251	+231	+211	+191
+310°	+432	+494	+515	+522	+524	+520	+509	+492	+472	+452	+432	+412	+392	+372	+352	+332	+312	+292	+272	+252	+232	+212	+192
+320°	+433	+495	+516	+523	+525	+521	+510	+493	+473	+453	+433	+413	+393	+373	+353	+333	+313	+293	+273	+253	+233	+213	+193
+330°	+434	+496	+517	+524	+526	+522	+511	+494	+474	+454	+434	+414	+394	+374	+354	+334	+314	+294	+274	+254	+234	+214	+194
+340°	+435	+497	+518	+525	+527	+523	+512	+495	+475	+455	+435	+415	+395	+375	+355	+335	+315	+295	+275	+255	+235	+215	+195
+350°	+436	+498	+519	+526	+528	+524	+513	+496	+476	+456	+436	+416	+396	+376	+356	+336	+316	+296	+276	+256	+236	+216	+196
+360°	+437	+499	+520	+527	+529	+525	+514	+497	+477	+457	+437	+417	+397	+377	+357	+337	+317	+297	+277	+257	+237	+217	+197
+370°	+438	+500	+521	+528	+530	+526	+515	+498	+478	+458	+438	+418	+398	+378	+358	+338	+318	+298	+278	+258	+238	+218	+198
+380°	+439	+501	+522	+529	+531	+527	+516	+499	+479	+459	+439	+419	+399	+379	+359	+339	+319	+299	+279	+259	+239	+219	+199
+390°	+440	+502	+523	+530	+532	+528	+517	+500	+480	+460	+440	+420	+400	+380	+360	+340	+320	+300	+280	+260	+240	+220	+200
+400°	+441	+503	+524	+531	+533	+529	+518	+501	+481	+461	+441	+421	+401	+381	+361	+341	+321	+301	+281	+261	+241	+221	+201
+410°	+442	+504	+525	+532	+534	+530	+519	+502	+482	+462	+442	+422	+402	+382	+362	+342	+322	+302	+282	+262	+242	+222	+202
+420°	+443	+505	+526	+533	+535	+531	+520	+503	+483	+463	+443	+423	+403	+383	+363	+343	+323	+303	+283	+263	+243	+223	+203
+430°	+444	+506	+527	+534	+536	+532	+521	+504	+484	+464	+444	+424	+404	+384	+364	+344	+324	+304	+284	+264	+244	+224	+204
+440°	+445	+507	+528	+535	+537	+533	+522	+505	+485	+465	+445	+425	+405	+385	+365	+345	+325	+305	+285	+265	+245	+225	+205
+450°	+446	+508	+529	+536	+538	+534	+523	+506	+486	+466	+446	+426	+406	+386	+366	+346	+326	+306	+286	+266	+246	+226	+206
+460°	+447	+509	+530	+537	+539	+535	+524	+507	+487	+467	+447	+427	+407	+387	+367	+347	+327	+307	+287	+267	+247	+227	+207
+470°	+448	+510	+531	+538	+540	+536	+525	+508	+488	+468	+448	+428	+408	+388	+368	+348	+328	+308	+288	+268	+248	+228	+208
+480°	+449	+511	+532	+539	+541	+537	+526	+509	+489	+469	+449	+429	+409	+389	+369	+349	+329	+309	+289	+269	+249	+229	+209
+490°	+450	+512	+533	+540	+542	+538	+527	+510	+490	+470	+450	+430	+410	+390	+370	+350	+330	+310	+290	+270	+250	+230	+210
+500°	+451	+513	+534	+541	+543	+539	+528	+511	+491	+471	+451	+431	+411	+391	+371	+351	+331	+311	+291	+271	+251	+231	+211

TABLE (44) Secular changes  $\Delta y$  between 1842-1885 when time is increased by one year.  
Gauss units of the 5th decimal

$\lambda = 0^\circ$	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°	195°	210°	225°	240°	255°	270°	285°	300°	315°	330°	345°
+50°	+239	+174	-25	-14	+70	+171	+219	+273	+311	+336	+297	+359	+174	+174	+174	+174	+174	+174	+174	+174	+174	+174	+174
+60°	+154	+168	-154	-183	-83	-10	+19	+78	+159	+159	+159	+137	+192	+192	+192	+192	+192	+192	+192	+192	+192	+192	+192
+70°	+184	-217	-182	-131	-65	-5	+25	+25	+142	+191	+174	+192	+192	+192	+192	+192	+192	+192	+192	+192	+192	+192	+192
+80°	+334	-322	-283	-234	-168	-97	-12	+72	+142	+184	+191	+192	+192	+192	+192	+192	+192	+192	+192	+192	+192	+192	+192
+90°	-260	-348	-343	-283	-205	-112	-39	+56	+144	+219	+250	+214	+139	+70	+14	+14	+14	+14	+14	+14	+14	+14	+14
+40°	-271	-393	-409	-310	-224	-128	-49	+30	+116	+228	+250	+212	+119	+70	+14	+14	+14	+14	+14	+14	+14	+14	+14
+30°	-284	-402	-419	-316	-237	-126	-54	+9	+88	+191	+223	+226	+139	+85	+49	+49	+49	+49	+49	+49	+49	+49	+49
+20°	-228	-411	-431	-353	-239	-102	-35	+19	+35	+137	+257	+257	+177	+44	+44	+44	+44	+44	+44	+44	+44	+44	+44
+10°	-163	-178	-410	-378	-207	-67	-16	-64	-35	+38	+201	+262	+205	+63	+75	+75	+75	+75	+75	+75	+75	+75	+75
0	-100	-316	-411	-323	-147	-7	-14	-81	-81	+111	+228	+198	+70	+55	+55	+55	+55	+55	+55	+55	+55	+55	+55
-10°	-14	-857	-362	-278	-114	+30	+44	-60	-116	-83	+42	+137	+198	+53	+61	+61	+61	+61	+61	+61	+61	+61	+61
-20°	+79	-170	-263	-321	-26	+23	+40	-28	-95	-105	-57	+35	+47	-2	-70	-142	-207	-184	-188	-188	-188	-188	-188
-30°	+205	-75	-214	-119	-19	+16	-9	0	-63	-88	-67	-47	-37	-37	-86	-144	-239	-316	-275	-253	-253	-253	-253
-40°	+318	+32	-168	-331	-198	-112	-35	0	-28	-56	-70	-77	-83	-83	-116	-191	-308	-385	-336	-316	-316	-316	-316
-50°	+395	+102	-152	-264	-267	-196	-93	0	+61	+70	+49	+5	-17	-83	-149	-204	-376	-446	-446	-446	-446	-446	-446
-60°	+388	+128	-114	-257	-295	-232	-114	+14	+123	+166	+156	+105	-58	-148	-166	-290	-402	-450	-450	-450	-450	-450	-450
-70°	+276	+93	-32	-209	-246	-201	-26	+42	+154	+214	+221	+186	+100	-148	-171	-378	-471	-490	-490	-490	-490	-490	-490
-80°	+123	+49	-86	-105	-83	-19	+65	+144	+198	+206	+170	+95	+2	-102	-128	-246	-246	-246	-246	-246	-246	-246	-246
-90°	-128	-59	+35	+116	+191	+250	+334	+318	+320	+300	+257	+201	+49	+128	-15	-116	-191	-250	-250	-250	-250	-250	-250



TABLE (45). Secular changes  $\Delta\lambda$  between 1550-1600 when the time is increased by one year. Gauss units of the 5th decimal. For  $\phi = +90^\circ$ ,  $\Delta\lambda = +0.00070$ ; for  $\phi = -90^\circ$ ,  $\Delta\lambda = +0.00036$ .

$\lambda^\circ$	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°	195°	210°	225°	240°	255°	270°	285°	300°	315°	330°	345°
+30°	+43	+40	+38	+36	+34	+32	+30	+28	+26	+24	+22	+20	+18	+16	+14	+12	+10	+8	+6	+4	+2	+1	+1
+20	+30	+28	+26	+24	+22	+20	+18	+16	+14	+12	+10	+8	+6	+4	+2	+1	+1	+1	+1	+1	+1	+1	+1
+10	+18	+16	+14	+12	+10	+8	+6	+4	+2	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1
0	+10	+8	+6	+4	+2	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1
-10	+20	+18	+16	+14	+12	+10	+8	+6	+4	+2	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1
-20	+30	+28	+26	+24	+22	+20	+18	+16	+14	+12	+10	+8	+6	+4	+2	+1	+1	+1	+1	+1	+1	+1	+1
-30	+43	+40	+38	+36	+34	+32	+30	+28	+26	+24	+22	+20	+18	+16	+14	+12	+10	+8	+6	+4	+2	+1	+1

TABLE (45). Secular changes  $\Delta\lambda$  between 1600-1650 when the time is increased by one year. Gauss units of the 5th decimal. For  $\phi = +90^\circ$ ,  $\Delta\lambda = +0.00088$ ; for  $\phi = -90^\circ$ ,  $\Delta\lambda = +0.00046$ .

$\lambda^\circ$	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°	195°	210°	225°	240°	255°	270°	285°	300°	315°	330°	345°
+30°	+43	+40	+38	+36	+34	+32	+30	+28	+26	+24	+22	+20	+18	+16	+14	+12	+10	+8	+6	+4	+2	+1	+1
+20	+30	+28	+26	+24	+22	+20	+18	+16	+14	+12	+10	+8	+6	+4	+2	+1	+1	+1	+1	+1	+1	+1	+1
+10	+18	+16	+14	+12	+10	+8	+6	+4	+2	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1
0	+10	+8	+6	+4	+2	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1
-10	+20	+18	+16	+14	+12	+10	+8	+6	+4	+2	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1
-20	+30	+28	+26	+24	+22	+20	+18	+16	+14	+12	+10	+8	+6	+4	+2	+1	+1	+1	+1	+1	+1	+1	+1
-30	+43	+40	+38	+36	+34	+32	+30	+28	+26	+24	+22	+20	+18	+16	+14	+12	+10	+8	+6	+4	+2	+1	+1

TABLE (45) Secular change  $\Delta\lambda$  between 1650-1700 when the time is increased by one year.  
G. units of the 5th decimal. For  $\varphi = +90^\circ$ ,  $\Delta\lambda = -0.000338$ ; for  $\varphi = -90^\circ$ ,  $\Delta\lambda = +0.00106$ .

$\varphi$	$\lambda = 0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$
$+80^\circ$	-34	-36	-46	-52	-62	-66	-86	-102	-114	-120	-114	-104	-74	-40	-2	+36	+62	+78	+81	+74	+58	+32	+16	-12
$+70^\circ$	-51	-78	-84	-78	-56	-48	-56	-90	-102	-112	-112	-170	-112	-50	+64	+150	+212	+238	+234	+192	+136	+78	+20	-36
$+60^\circ$	-130	-192	-220	-182	-78	-42	-28	-28	-162	-162	-108	-268	-154	-52	+80	+232	+332	+392	+392	+320	+214	+106	+12	-60
$+50^\circ$	-164	-222	-246	-196	-128	-64	+30	+18	-148	-148	-84	-266	-222	-158	-8	+204	+366	+472	+512	+468	+350	+188	+54	-24
$+40^\circ$	-162	-254	-278	-206	-128	-62	+32	+22	-110	-110	-10	-178	-342	-258	-186	-82	+306	+478	+592	+630	+574	+422	+192	+14
$+30^\circ$	-66	-500	-976	-1092	-700	-72	+348	+416	+326	+326	+132	-156	-484	-604	-608	-82	+804	+924	+1036	+1036	+936	+748	+516	+136
$+20^\circ$	+76	-464	-1116	-1354	-936	-218	+266	+324	+324	+324	+212	-138	-538	-758	-758	-152	+140	+370	+622	+926	+936	+696	+448	+106
$+10^\circ$	+188	-404	-1160	-1428	-1066	-380	+114	+212	+206	+212	+122	-148	-618	-764	-764	-322	+158	+336	+622	+1050	+1110	+852	+520	+208
$0^\circ$	+196	-374	-1176	-1478	-1162	-506	-64	+10	+102	+124	+124	-150	-516	-602	-724	-724	+226	+336	+728	+1102	+1198	+916	+536	+142
$-10^\circ$	+444	-362	-1022	-1368	-1124	-578	-378	-182	-228	-144	-54	-150	-346	-442	-102	+152	+338	+634	+786	+1134	+1216	+936	+578	+266
$-20^\circ$	+774	-368	-900	-1176	-998	-592	-378	-356	-430	-372	-328	-168	-168	-92	+80	+230	+314	+468	+786	+1112	+1162	+904	+552	+116
$-30^\circ$	+336	-324	-730	-996	-836	-574	-432	-498	-596	-570	-498	-212	-60	+60	+162	+230	+284	+446	+722	+1036	+1084	+862	+520	+292
$-40^\circ$	+66	-222	-506	-672	-656	-528	-496	-584	-698	-668	-494	-246	-34	+102	+162	+184	+238	+400	+624	+896	+946	+796	+550	+310
$-50^\circ$	+100	-22	-392	-420	-476	-484	-518	-608	-680	-646	-492	-270	-70	+66	+116	+138	+196	+348	+578	+764	+880	+722	+552	+258
$-60^\circ$	+228	+66	-290	-322	-308	-376	-446	-518	-592	-544	-414	-254	-104	+6	+66	+116	+196	+316	+466	+592	+648	+478	+318	+322
$-70^\circ$	+328	+34	+18	-72	-156	-232	-296	-344	-360	-332	-272	-182	-82	-2	+64	+128	+204	+284	+432	+544	+648	+472	+314	+346
$-80^\circ$	+206	+156	+100	+46	-10	-52	-34	-120	-118	-82	-42	-56	-10	+16	+82	+130	+178	+220	+258	+288	+302	+302	+230	+248

TABLE (45) Secular change  $\Delta\lambda$  between 1700-1780 when the time is increased by one year.  
G. units of the 5th decimal. For  $\varphi = +90^\circ$ ,  $\Delta\lambda = -0.00338$ ; for  $\varphi = -90^\circ$ ,  $\Delta\lambda = +0.00391$ .

$\varphi$	$\lambda = 0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$
$+80^\circ$	-444	-438	-405	-344	-344	-180	-22	-152	-216	-282	-300	+44	+15	-19	-51	-87	-121	-157	-200	-248	-296	-348	-392	-436
$+70^\circ$	-576	-610	-577	-471	-304	-111	+15	+216	+282	+300	+246	+162	+71	-15	-51	-87	-121	-157	-200	-248	-296	-348	-392	-436
$+60^\circ$	-235	-631	-675	-517	-321	-48	+205	+380	+472	+395	+252	+75	-60	-181	-97	-31	+39	+75	+82	+82	+49	-35	-75	-361
$+50^\circ$	-410	-602	-665	-567	-373	-36	+144	+274	+442	+377	+105	-144	-314	-335	-255	-87	+62	+174	+235	+235	+311	+262	+105	-142
$+40^\circ$	-270	-520	-624	-571	-348	-50	+229	+370	+348	+173	-89	-355	-560	-564	-393	-136	+82	+230	+336	+445	+530	+504	+331	+45
$+30^\circ$	-191	-471	-631	-556	-375	-66	+192	+304	+245	+51	-229	-518	-701	-697	-456	-166	+77	+249	+345	+443	+447	+676	+426	+136
$+20^\circ$	-150	-460	-670	-670	-432	-82	+148	+280	+201	+7	-257	-535	-697	-650	-423	-139	+85	+237	+418	+614	+705	+642	+439	+164
$+10^\circ$	-99	-454	-712	-712	-496	-115	+171	+272	+216	+44	-304	-541	-523	-496	-367	-52	+101	+260	+476	+734	+627	+430	+195	
$0^\circ$	-33	-437	-720	-636	-571	-123	+101	+211	+213	+104	-114	-337	-414	-414	-371	-71	+114	+243	+376	+573	+786	+648	+370	+252
$-10^\circ$	+11	-423	-700	-666	-638	-299	-60	+62	+112	+106	-42	-280	-414	-414	-371	-71	+114	+243	+376	+573	+786	+648	+370	+252
$-20^\circ$	+34	-386	-720	-811	-646	-424	-271	-158	-91	+23	-27	-121	-106	-64	+100	+127	+41	+123	+443	+773	+901	+777	+602	+146
$-30^\circ$	+44	-336	-607	-674	-604	-516	-462	-381	-243	-111	-79	-94	-61	+44	+29	+31	-39	+84	+373	+583	+729	+829	+676	+391
$-40^\circ$	+115	-193	-401	-479	-489	-517	-554	-515	-423	-216	-203	-174	-137	-79	-64	-104	-100	+85	+445	+627	+827	+954	+764	+452
$-50^\circ$	+291	+47	-125	-189	-308	-407	-505	-544	-506	-418	-342	-301	-271	-246	-191	-151	-89	+152	+518	+835	+1054	+1240	+840	+586
$-60^\circ$	+106	+307	+150	+23	-97	-233	-354	-439	-462	-446	-446	-387	-361	-327	-270	-174	-72	+235	+558	+835	+1054	+1240	+840	+586
$-70^\circ$	+636	+495	+363	+435	+104	-27	-146	-239	-301	-332	-332	-324	-324	-324	-324	-324	-324	+235	+558	+835	+1054	+1240	+840	+586
$-80^\circ$	+568	+491	+414	+329	+243	+160	+84	+17	-34	-66	-82	-76	-52	-52	-6	+57	+143	+243	+320	+426	+548	+644	+644	+616

ORIGINAL PAGE 19  
OF FOUR QUALITY



TABLE (45). Secular change  $\Delta Z$  between 1780-1842 when the time is increased by one year.  
G units of the 5th decimal. For  $\phi = +90^\circ$ ,  $\Delta Z = +0.00065$  ; for  $\phi = -90^\circ$ ,  $\Delta Z = -0.00053$ .

$\phi$	$\lambda = 0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$
$+80^\circ$	+179	+186	+193	+200	+207	+214	+221	+228	+235	+242	+249	+256	+263	+270	+277	+284	+291	+298	+305	+312	+319	+326	+333	+340
$+70^\circ$	+182	+189	+196	+203	+210	+217	+224	+231	+238	+245	+252	+259	+266	+273	+280	+287	+294	+301	+308	+315	+322	+329	+336	+343
$+60^\circ$	+185	+192	+199	+206	+213	+220	+227	+234	+241	+248	+255	+262	+269	+276	+283	+290	+297	+304	+311	+318	+325	+332	+339	+346
$+50^\circ$	+188	+195	+202	+209	+216	+223	+230	+237	+244	+251	+258	+265	+272	+279	+286	+293	+300	+307	+314	+321	+328	+335	+342	+349
$+40^\circ$	+191	+198	+205	+212	+219	+226	+233	+240	+247	+254	+261	+268	+275	+282	+289	+296	+303	+310	+317	+324	+331	+338	+345	+352
$+30^\circ$	+194	+201	+208	+215	+222	+229	+236	+243	+250	+257	+264	+271	+278	+285	+292	+299	+306	+313	+320	+327	+334	+341	+348	+355
$+20^\circ$	+197	+204	+211	+218	+225	+232	+239	+246	+253	+260	+267	+274	+281	+288	+295	+302	+309	+316	+323	+330	+337	+344	+351	+358
$+10^\circ$	+200	+207	+214	+221	+228	+235	+242	+249	+256	+263	+270	+277	+284	+291	+298	+305	+312	+319	+326	+333	+340	+347	+354	+361
$0^\circ$	+203	+210	+217	+224	+231	+238	+245	+252	+259	+266	+273	+280	+287	+294	+301	+308	+315	+322	+329	+336	+343	+350	+357	+364
$-10^\circ$	+206	+213	+220	+227	+234	+241	+248	+255	+262	+269	+276	+283	+290	+297	+304	+311	+318	+325	+332	+339	+346	+353	+360	+367
$-20^\circ$	+209	+216	+223	+230	+237	+244	+251	+258	+265	+272	+279	+286	+293	+300	+307	+314	+321	+328	+335	+342	+349	+356	+363	+370
$-30^\circ$	+212	+219	+226	+233	+240	+247	+254	+261	+268	+275	+282	+289	+296	+303	+310	+317	+324	+331	+338	+345	+352	+359	+366	+373
$-40^\circ$	+215	+222	+229	+236	+243	+250	+257	+264	+271	+278	+285	+292	+299	+306	+313	+320	+327	+334	+341	+348	+355	+362	+369	+376
$-50^\circ$	+218	+225	+232	+239	+246	+253	+260	+267	+274	+281	+288	+295	+302	+309	+316	+323	+330	+337	+344	+351	+358	+365	+372	+379
$-60^\circ$	+221	+228	+235	+242	+249	+256	+263	+270	+277	+284	+291	+298	+305	+312	+319	+326	+333	+340	+347	+354	+361	+368	+375	+382
$-70^\circ$	+224	+231	+238	+245	+252	+259	+266	+273	+280	+287	+294	+301	+308	+315	+322	+329	+336	+343	+350	+357	+364	+371	+378	+385
$-80^\circ$	+227	+234	+241	+248	+255	+262	+269	+276	+283	+290	+297	+304	+311	+318	+325	+332	+339	+346	+353	+360	+367	+374	+381	+388

TABLE (45) Secular change  $\Delta Z$  between 1842-1885 when the time is increased by one year.  
G. units of the 5th decimal For  $\phi = +90^\circ$ ,  $\Delta Z = +0.00041$  ; for  $\phi = -90^\circ$ ,  $\Delta Z = -0.00033$ .

$\phi$	$\lambda = 0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$
$+80^\circ$	+320	+327	+334	+341	+348	+355	+362	+369	+376	+383	+390	+397	+404	+411	+418	+425	+432	+439	+446	+453	+460	+467	+474	+481
$+70^\circ$	+323	+330	+337	+344	+351	+358	+365	+372	+379	+386	+393	+400	+407	+414	+421	+428	+435	+442	+449	+456	+463	+470	+477	+484
$+60^\circ$	+326	+333	+340	+347	+354	+361	+368	+375	+382	+389	+396	+403	+410	+417	+424	+431	+438	+445	+452	+459	+466	+473	+480	+487
$+50^\circ$	+329	+336	+343	+350	+357	+364	+371	+378	+385	+392	+399	+406	+413	+420	+427	+434	+441	+448	+455	+462	+469	+476	+483	+490
$+40^\circ$	+332	+339	+346	+353	+360	+367	+374	+381	+388	+395	+402	+409	+416	+423	+430	+437	+444	+451	+458	+465	+472	+479	+486	+493
$+30^\circ$	+335	+342	+349	+356	+363	+370	+377	+384	+391	+398	+405	+412	+419	+426	+433	+440	+447	+454	+461	+468	+475	+482	+489	+496
$+20^\circ$	+338	+345	+352	+359	+366	+373	+380	+387	+394	+401	+408	+415	+422	+429	+436	+443	+450	+457	+464	+471	+478	+485	+492	+499
$+10^\circ$	+341	+348	+355	+362	+369	+376	+383	+390	+397	+404	+411	+418	+425	+432	+439	+446	+453	+460	+467	+474	+481	+488	+495	+502
$0^\circ$	+344	+351	+358	+365	+372	+379	+386	+393	+400	+407	+414	+421	+428	+435	+442	+449	+456	+463	+470	+477	+484	+491	+498	+505
$-10^\circ$	+347	+354	+361	+368	+375	+382	+389	+396	+403	+410	+417	+424	+431	+438	+445	+452	+459	+466	+473	+480	+487	+494	+501	+508
$-20^\circ$	+350	+357	+364	+371	+378	+385	+392	+399	+406	+413	+420	+427	+434	+441	+448	+455	+462	+469	+476	+483	+490	+497	+504	+511
$-30^\circ$	+353	+360	+367	+374	+381	+388	+395	+402	+409	+416	+423	+430	+437	+444	+451	+458	+465	+472	+479	+486	+493	+500	+507	+514
$-40^\circ$	+356	+363	+370	+377	+384	+391	+398	+405	+412	+419	+426	+433	+440	+447	+454	+461	+468	+475	+482	+489	+496	+503	+510	+517
$-50^\circ$	+359	+366	+373	+380	+387	+394	+401	+408	+415	+422	+429	+436	+443	+450	+457	+464	+471	+478	+485	+492	+499	+506	+513	+520
$-60^\circ$	+362	+369	+376	+383	+390	+397	+404	+411	+418	+425	+432	+439	+446	+453	+460	+467	+474	+481	+488	+495	+502	+509	+516	+523
$-70^\circ$	+365	+372	+379	+386	+393	+400	+407	+414	+421	+428	+435	+442	+449	+456	+463	+470	+477	+484	+491	+498	+505	+512	+519	+526
$-80^\circ$	+368	+375	+382	+389	+396	+403	+410	+417	+424	+431	+438	+445	+452	+459	+466	+473	+480	+487	+494	+501	+508	+515	+522	+529

TABLE (46). Secular changes  $\Delta\delta$  between 1550-1600 when time is increased by one year.  
Minutes

$\phi$	$\lambda=0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$	
$+80^\circ$	-1.40	-1.60	-3.18	-6.10	-8.33	-8.76	-7.60	-5.14	-3.18	-0.81	+1.58	+4.30	+6.71	+9.63	+12.00	+14.84	+6.34	-8.46	-20.50	-16.44	-10.52	-7.42	-5.30	-3.66	-2.38
$+70$	+3.44	+5.66	+5.10	-0.40	-4.86	-9.08	-8.16	-5.84	-3.19	-0.40	+2.10	+4.32	+6.24	+8.10	+10.10	+11.84	+6.34	-8.46	-20.50	-16.44	-10.52	-7.42	-5.30	-3.66	-2.38
$+60$	+4.34	+7.08	+7.61	+2.93	-3.84	-7.30	-7.48	-5.94	-3.56	-0.82	+1.48	+3.12	+4.10	+5.22	+6.32	+7.00	+1.84	-1.70	-4.74	-5.10	-3.74	-2.30	-0.38	+1.88	+1.88
$+50$	+4.12	+4.72	+7.30	+4.48	-1.34	-4.96	-6.00	-5.24	-3.46	-1.12	+0.56	+1.96	+2.58	+3.28	+3.12	+1.60	+0.86	-0.52	-2.62	-3.78	-3.74	-2.30	-0.36	+1.76	+1.76
$+40$	+3.74	+6.10	+7.52	+4.98	+0.10	-3.30	-4.54	-4.22	-3.02	-1.60	-0.10	+1.08	+1.88	+1.70	+0.56	+0.48	-0.10	-1.64	-3.18	-3.58	-2.54	-0.56	+1.52	+1.52	+1.52
$+30$	+3.40	+5.64	+6.86	+4.86	+0.76	-2.24	-3.40	-3.20	-2.50	-1.86	-0.90	+0.38	+1.74	+1.80	+0.60	-0.16	-0.72	-0.86	-2.44	-2.44	-2.44	-2.44	-2.44	-2.44	-2.44
$+20$	+3.34	+5.18	+6.54	+4.82	-1.88	-2.76	-3.20	-2.92	-2.06	-1.26	-0.02	+1.02	+1.50	+1.00	+0.24	-0.86	-0.72	-0.64	-2.10	-2.10	-2.10	-2.10	-2.10	-2.10	-2.10
$+10$	+3.38	+5.16	+6.16	+4.32	+0.66	-1.96	-2.60	-2.70	-1.36	-0.30	-1.08	-0.32	+1.08	+1.88	-0.06	-1.36	-0.70	-0.34	-1.94	-3.26	-3.26	-3.26	-3.26	-3.26	-3.26
$0$	+3.38	+5.34	+5.92	+4.06	+0.52	-2.26	-2.72	-1.36	-0.30	-1.36	-0.32	+1.08	+1.88	+1.88	-0.06	-1.46	-0.80	-0.50	-1.94	-3.26	-3.26	-3.26	-3.26	-3.26	-3.26
$-10$	+4.26	+5.38	+5.78	+4.08	+0.70	-2.20	-3.06	-1.34	-0.66	-1.38	-0.68	+1.04	+0.54	+0.92	-0.22	-1.12	-0.30	+1.00	-0.32	-2.26	-3.26	-3.26	-3.26	-3.26	-3.26
$-20$	+4.78	+6.52	+5.94	+4.28	+1.18	-2.38	-3.18	-1.66	-0.78	-2.06	-1.34	-2.16	-0.56	-0.06	-0.32	-0.54	-0.44	+1.36	+0.12	-2.84	-4.48	-3.94	-0.40	+0.40	+3.14
$-30$	+5.40	+6.24	+6.44	+5.08	+1.96	-1.50	-3.16	-2.12	-1.38	-2.64	-1.98	-3.42	-1.86	-0.68	-0.36	+0.18	+1.34	+1.64	-0.74	-3.74	-5.14	-5.04	-0.74	+0.74	+3.70
$-40$	+6.18	+6.92	+6.48	+5.66	+3.14	-0.08	-3.44	-2.42	-1.74	-3.22	-2.82	-4.78	-1.98	-1.72	-0.34	+0.04	+1.86	+1.30	-1.46	-4.76	-5.62	-5.66	-1.48	+4.38	+4.38
$-50$	+6.92	+7.64	+7.34	+6.24	+4.30	+1.74	-4.06	-1.56	-2.54	-4.36	-3.28	-6.54	-2.80	-2.50	-0.78	+1.46	+1.80	+0.30	-2.76	-5.82	-5.60	-1.78	+2.54	+5.46	+5.46
$-60$	+7.52	+7.78	+7.60	+6.66	+5.32	+3.40	+1.10	+0.32	-3.04	-5.06	-4.04	-8.16	-4.18	-3.10	-0.68	+0.78	+0.70	-1.44	-4.44	-6.12	-4.38	+0.12	+3.96	+6.34	+6.34
$-70$	+8.16	+8.28	+8.10	+7.44	+6.60	+5.60	+4.50	+3.34	+0.80	-5.12	-10.06	-12.92	-10.18	-6.50	-3.42	-2.18	-2.78	-4.50	-5.96	-4.88	+0.12	+3.24	+6.12	+7.60	+7.60
$-80$	+9.10	+9.48	+9.30	+8.42	+8.72	+8.64	+8.24	+7.38	+5.44	-0.70	-2.80	-3.08	-2.80	-3.08	-3.42	-3.08	-1.76	-3.68	-4.50	-5.32	+7.12	+8.86	+9.04	+9.44	+9.44
$-90^\circ$	+9.20	+10.08	+10.38	+8.24	+9.20	+9.20	+10.16	+8.34	+5.34	-1.34	-3.34	-3.34	-3.34	-3.34	-3.34	-3.34	-3.34	-3.34	-3.34	-3.34	-3.34	-3.34	-3.34	-3.34	-3.34

TABLE (46). Secular changes  $\Delta\delta$  between 1600-1650 when time is increased by one year.  
Minutes. For  $\phi=+90^\circ$ ,  $\Delta\delta=-1.06$ ; for  $\phi=-90^\circ$ ,  $\Delta\delta=+1.12$ .

$\phi$	$\lambda=0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$	
$+40^\circ$	+5.12	+3.78	+3.62	-7.68	-10.10	-2.86	-7.88	-5.96	-1.78	+1.84	+5.12	+8.06	+11.36	+15.54	+13.72	-13.32	-5.02	-1.04	+0.64	+1.58	+3.94	+5.12	+5.12	+5.12	+5.12
$+30^\circ$	+5.32	+5.12	+0.92	-7.04	-9.32	-9.74	-7.44	-3.88	-0.16	+2.96	+4.92	+6.18	+6.38	+5.54	+2.16	-5.44	-3.68	-1.06	+1.28	+3.54	+5.64	+7.78	+7.78	+7.78	+7.78
$+20^\circ$	+5.64	+10.46	+8.02	+1.44	-4.84	-7.38	-8.10	-6.12	-3.14	-0.10	+2.36	+3.28	+3.78	+2.62	+0.86	-7.48	-3.10	-4.94	-4.68	-2.76	-0.10	+2.62	+5.36	+7.22	+7.22
$+10^\circ$	+6.24	+9.26	+8.08	+3.04	-2.52	-5.78	-6.48	-5.12	-3.84	-0.22	+1.74	+2.78	+2.52	+0.98	-1.04	-2.36	-2.46	-2.64	-3.06	-2.90	-1.32	+1.30	+4.22	+6.52	+6.52
$+0^\circ$	+6.70	+7.04	+7.28	+3.62	-1.10	-4.10	-5.00	-3.90	-2.06	-0.18	+1.00	+1.82	+1.80	+0.30	-1.78	-3.64	-2.32	-1.62	-1.96	-2.48	-1.86	+0.58	+3.58	+5.52	+5.52
$-10^\circ$	+5.62	+6.72	+6.74	+3.66	-0.58	-3.40	-3.98	-3.80	-1.32	-0.46	+0.28	+1.08	+1.76	+0.52	-2.16	-3.16	-2.36	-1.26	-1.14	-1.86	-1.82	+0.04	+2.60	+4.54	+4.54
$-20^\circ$	+4.78	+5.96	+5.94	+3.16	-0.48	-3.06	-3.34	-1.78	-0.58	-0.38	-0.20	+0.96	+2.00	+0.22	-2.44	-3.86	-2.78	-0.94	-0.56	-1.46	-1.88	-0.34	+2.26	+4.06	+4.06
$-30^\circ$	+4.78	+5.36	+2.88	+2.88	-0.74	-3.30	-3.16	-0.94	+0.16	-0.22	-0.56	+0.60	+2.04	+1.02	-3.32	-4.24	-3.10	-0.78	-0.18	-1.28	-1.26	-0.56	+2.08	+3.96	+3.96
$-40^\circ$	+4.66	+5.36	+2.88	+2.88	-0.74	-3.30	-3.16	-0.94	+0.16	-0.22	-0.56	+0.60	+2.04	+1.02	-3.32	-4.24	-3.10	-0.78	-0.18	-1.28	-1.26	-0.56	+2.08	+3.96	+3.96
$-50^\circ$	+4.66	+5.36	+2.88	+2.88	-0.74	-3.30	-3.16	-0.94	+0.16	-0.22	-0.56	+0.60	+2.04	+1.02	-3.32	-4.24	-3.10	-0.78	-0.18	-1.28	-1.26	-0.56	+2.08	+3.96	+3.96
$-60^\circ$	+4.66	+5.36	+2.88	+2.88	-0.74	-3.30	-3.16	-0.94	+0.16	-0.22	-0.56	+0.60	+2.04	+1.02	-3.32	-4.24	-3.10	-0.78	-0.18	-1.28	-1.26	-0.56	+2.08	+3.96	+3.96
$-70^\circ$	+4.66	+5.36	+2.88	+2.88	-0.74	-3.30	-3.16	-0.94	+0.16	-0.22	-0.56	+0.60	+2.04	+1.02	-3.32	-4.24	-3.10	-0.78	-0.18	-1.28	-1.26	-0.56	+2.08	+3.96	+3.96
$-80^\circ$	+4.66	+5.36	+2.88	+2.88	-0.74	-3.30	-3.16	-0.94	+0.16	-0.22	-0.56	+0.60	+2.04	+1.02	-3.32	-4.24	-3.10	-0.78	-0.18	-1.28	-1.26	-0.56	+2.08	+3.96	+3.96
$-90^\circ$	+4.66	+5.36	+2.88	+2.88	-0.74	-3.30	-3.16	-0.94	+0.16	-0.22	-0.56	+0.60	+2.04	+1.02	-3.32	-4.24	-3.10	-0.78	-0.18	-1.28	-1.26	-0.56	+2.08	+3.96	+3.96

secular changes  $\Delta\delta$  of declination  $\delta$



TABLE (46) Secular changes  $\Delta\delta$  in minutes between 1780 and 1842 when the time is increased by one year. For  $\varphi = +90^\circ$ ,  $\delta = +13.32$ ; for  $\varphi = -90^\circ$ ,  $\delta = -13.32$ .

$\varphi$	$\lambda = 0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$
$+88^\circ$	$+7.84$	$+7.61$	$+7.18$	$+6.65$	$+6.02$	$+5.29$	$+4.46$	$+3.54$	$+2.52$	$+1.40$	$+0.19$	$-0.83$	$-1.84$	$-2.85$	$-3.86$	$-4.87$	$-5.88$	$-6.89$	$-7.90$	$-8.91$	$-9.92$	$-10.93$	$-11.94$	$-12.95$
$+70^\circ$	$+5.60$	$+5.34$	$+4.98$	$+4.51$	$+3.94$	$+3.26$	$+2.49$	$+1.61$	$+0.64$	$-0.38$	$-1.40$	$-2.41$	$-3.42$	$-4.43$	$-5.44$	$-6.45$	$-7.46$	$-8.47$	$-9.48$	$-10.49$	$-11.50$	$-12.51$	$-13.52$	$-14.53$
$+50^\circ$	$+2.58$	$+2.35$	$+2.03$	$+1.61$	$+1.09$	$+0.47$	$-0.25$	$-1.07$	$-1.89$	$-2.71$	$-3.53$	$-4.35$	$-5.17$	$-5.99$	$-6.81$	$-7.63$	$-8.45$	$-9.27$	$-10.09$	$-10.91$	$-11.73$	$-12.55$	$-13.37$	$-14.19$
$+30^\circ$	$+1.16$	$+0.95$	$+0.65$	$+0.26$	$-0.21$	$-0.78$	$-1.35$	$-1.92$	$-2.49$	$-3.06$	$-3.63$	$-4.20$	$-4.77$	$-5.34$	$-5.91$	$-6.48$	$-7.05$	$-7.62$	$-8.19$	$-8.76$	$-9.33$	$-9.90$	$-10.47$	$-11.04$
$+10^\circ$	$+0.46$	$+0.37$	$+0.25$	$+0.10$	$-0.16$	$-0.42$	$-0.68$	$-0.94$	$-1.20$	$-1.46$	$-1.72$	$-1.98$	$-2.24$	$-2.50$	$-2.76$	$-3.02$	$-3.28$	$-3.54$	$-3.80$	$-4.06$	$-4.32$	$-4.58$	$-4.84$	$-5.10$
$-10^\circ$	$-0.46$	$-0.37$	$-0.25$	$-0.10$	$+0.16$	$+0.42$	$+0.68$	$+0.94$	$+1.20$	$+1.46$	$+1.72$	$+1.98$	$+2.24$	$+2.50$	$+2.76$	$+3.02$	$+3.28$	$+3.54$	$+3.80$	$+4.06$	$+4.32$	$+4.58$	$+4.84$	$+5.10$
$-30^\circ$	$-1.16$	$-0.95$	$-0.65$	$-0.26$	$+0.21$	$+0.78$	$+1.35$	$+1.92$	$+2.49$	$+3.06$	$+3.63$	$+4.20$	$+4.77$	$+5.34$	$+5.91$	$+6.48$	$+7.05$	$+7.62$	$+8.19$	$+8.76$	$+9.33$	$+9.90$	$+10.47$	$+11.04$
$-50^\circ$	$-2.58$	$-2.35$	$-2.03$	$-1.61$	$-1.09$	$-0.47$	$+0.25$	$+1.07$	$+1.89$	$+2.71$	$+3.53$	$+4.35$	$+5.17$	$+5.99$	$+6.81$	$+7.63$	$+8.45$	$+9.27$	$+10.09$	$+10.91$	$+11.73$	$+12.55$	$+13.37$	$+14.19$
$-70^\circ$	$-5.60$	$-5.34$	$-4.98$	$-4.51$	$-3.94$	$-3.26$	$-2.49$	$-1.61$	$-0.64$	$+0.38$	$+1.40$	$+2.41$	$+3.42$	$+4.43$	$+5.44$	$+6.45$	$+7.46$	$+8.47$	$+9.48$	$+10.49$	$+11.50$	$+12.51$	$+13.52$	$+14.53$
$-88^\circ$	$-7.84$	$-7.61$	$-7.18$	$-6.65$	$-6.02$	$-5.29$	$-4.46$	$-3.54$	$-2.52$	$-1.40$	$-0.19$	$+0.83$	$+1.84$	$+2.85$	$+3.86$	$+4.87$	$+5.88$	$+6.89$	$+7.90$	$+8.91$	$+9.92$	$+10.93$	$+11.94$	$+12.95$

TABLE (46) Secular changes  $\Delta\delta$  in minutes between 1842 and 1885 when the time is increased by one year. For  $\varphi = +90^\circ$ ,  $\delta = +13.32$ ; for  $\varphi = -90^\circ$ ,  $\delta = -13.32$ .

$\varphi$	$\lambda = 0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$
$+88^\circ$	$+4.26$	$+4.23$	$+4.15$	$+4.05$	$+3.94$	$+3.81$	$+3.67$	$+3.52$	$+3.37$	$+3.21$	$+3.04$	$+2.87$	$+2.69$	$+2.51$	$+2.33$	$+2.15$	$+1.97$	$+1.79$	$+1.61$	$+1.43$	$+1.25$	$+1.07$	$+0.89$	$+0.71$
$+70^\circ$	$+3.07$	$+3.06$	$+3.02$	$+2.96$	$+2.88$	$+2.79$	$+2.69$	$+2.58$	$+2.46$	$+2.33$	$+2.19$	$+2.05$	$+1.91$	$+1.77$	$+1.62$	$+1.47$	$+1.32$	$+1.17$	$+1.02$	$+0.87$	$+0.72$	$+0.57$	$+0.42$	$+0.27$
$+50^\circ$	$+1.78$	$+1.76$	$+1.72$	$+1.65$	$+1.56$	$+1.46$	$+1.34$	$+1.21$	$+1.07$	$+0.92$	$+0.77$	$+0.61$	$+0.45$	$+0.29$	$+0.13$	$-0.03$	$-0.19$	$-0.35$	$-0.51$	$-0.67$	$-0.83$	$-0.99$	$-1.15$	$-1.31$
$+30^\circ$	$+0.79$	$+0.77$	$+0.73$	$+0.66$	$+0.57$	$+0.47$	$+0.35$	$+0.22$	$+0.08$	$-0.07$	$-0.23$	$-0.39$	$-0.55$	$-0.71$	$-0.87$	$-1.03$	$-1.19$	$-1.35$	$-1.51$	$-1.67$	$-1.83$	$-1.99$	$-2.15$	$-2.31$
$+10^\circ$	$+0.25$	$+0.24$	$+0.22$	$+0.18$	$+0.12$	$+0.05$	$-0.03$	$-0.10$	$-0.17$	$-0.24$	$-0.31$	$-0.38$	$-0.45$	$-0.52$	$-0.59$	$-0.66$	$-0.73$	$-0.80$	$-0.87$	$-0.94$	$-1.01$	$-1.08$	$-1.15$	$-1.22$
$-10^\circ$	$-0.25$	$-0.24$	$-0.22$	$-0.18$	$-0.12$	$-0.05$	$+0.03$	$+0.10$	$+0.17$	$+0.24$	$+0.31$	$+0.38$	$+0.45$	$+0.52$	$+0.59$	$+0.66$	$+0.73$	$+0.80$	$+0.87$	$+0.94$	$+1.01$	$+1.08$	$+1.15$	$+1.22$
$-30^\circ$	$-0.79$	$-0.77$	$-0.73$	$-0.66$	$-0.57$	$-0.47$	$-0.35$	$-0.22$	$-0.08$	$+0.07$	$+0.23$	$+0.39$	$+0.55$	$+0.71$	$+0.87$	$+1.03$	$+1.19$	$+1.35$	$+1.51$	$+1.67$	$+1.83$	$+1.99$	$+2.15$	$+2.31$
$-50^\circ$	$-1.78$	$-1.76$	$-1.72$	$-1.65$	$-1.56$	$-1.46$	$-1.34$	$-1.21$	$-1.07$	$-0.92$	$-0.77$	$-0.61$	$-0.45$	$-0.29$	$-0.13$	$+0.03$	$+0.19$	$+0.35$	$+0.51$	$+0.67$	$+0.83$	$+0.99$	$+1.15$	$+1.31$
$-70^\circ$	$-3.07$	$-3.06$	$-3.02$	$-2.96$	$-2.88$	$-2.79$	$-2.69$	$-2.58$	$-2.46$	$-2.33$	$-2.19$	$-2.05$	$-1.91$	$-1.77$	$-1.62$	$-1.47$	$-1.32$	$-1.17$	$-1.02$	$-0.87$	$-0.72$	$-0.57$	$-0.42$	$-0.27$
$-88^\circ$	$-4.26$	$-4.23$	$-4.15$	$-4.05$	$-3.94$	$-3.81$	$-3.67$	$-3.52$	$-3.37$	$-3.21$	$-3.04$	$-2.87$	$-2.69$	$-2.51$	$-2.33$	$-2.15$	$-1.97$	$-1.79$	$-1.61$	$-1.43$	$-1.25$	$-1.07$	$-0.89$	$-0.71$

Secular changes  $\Delta\delta$  of declination  $\delta$

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Secular changes  $\Delta i$  of inclination i

TABLE (47) Secular changes  $\Delta i$  in minutes between 1600-1650 when time is increased by one year. For  $\eta = +90^\circ$ ,  $\Delta i = +0.1/2$ . ; for  $\eta = -90^\circ$ ,  $\Delta i = +0.1/2$ .

$\eta$	$\lambda=0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$	
+80°	-2.50	-0.50	-0.94	-0.56	-0.30	-0.52	0.00	-0.40	+0.78	+1.1	+0.78	+0.82	+0.66	+0.46	+0.58	+0.32	+0.50	+0.16	+0.70	+0.50	+0.58	+0.56	+0.54	+0.70	-0.56
+70	-0.16	-0.84	-1.59	-1.98	-1.86	-1.28	-0.94	-0.98	+0.80	+0.98	+0.82	+0.68	+0.38	+0.03	-0.28	-0.51	-0.33	+0.38	+0.70	+1.00	+1.18	+1.12	+0.86	+0.52	
+60	+0.32	-6.68	-2.72	-2.76	-2.14	-1.08	-0.06	-0.64	+0.36	+0.30	+0.50	+0.05	-0.05	-0.16	-0.24	-0.01	+0.10	+0.51	+1.09	+1.54	+1.32	+1.90	+1.66	+1.14	
+50	+1.00	-0.20	-1.80	-1.30	-1.60	-2.98	-1.76	-0.52	+0.36	+0.36	+0.05	+0.05	-0.30	-0.68	-0.23	+0.26	+0.68	+0.94	+1.24	+1.78	+2.18	+2.50	+2.80	+1.28	
+55	+1.42	+0.16	-1.70	-3.54	-2.36	-3.80	-2.28	-1.08	-0.24	+0.06	+0.05	-0.14	-0.64	-1.00	-0.65	+0.32	+1.16	+1.38	+1.68	+2.36	+2.78	+3.14	+3.02	+2.30	
+30	+1.72	+0.28	-1.90	-4.34	-3.86	-5.52	-2.54	-0.98	-0.58	-0.35	-0.10	-0.10	-0.26	-0.72	-1.52	+0.20	+1.64	+2.04	+2.82	+2.70	+3.06	+3.08	+3.70	+2.48	
+20	+1.74	+0.60	-2.46	-5.20	-6.48	-5.02	-2.18	-0.98	-0.70	-0.54	-0.26	+0.02	-0.28	-2.92	-1.28	+1.18	+2.76	+2.90	+2.72	+3.10	+3.56	+4.72	+4.58	+3.64	
+10	+1.62	+0.50	-3.48	-6.56	-7.38	-6.78	-0.98	-0.62	-0.54	-0.26	+0.18	+0.18	-0.28	-3.06	-0.52	+1.20	+2.74	+3.86	+3.68	+3.70	+5.62	+5.68	+5.48	+4.02	
0	+1.22	-1.54	-0.88	-1.22	-2.62	-3.58	+0.22	+0.22	-0.12	-1.18	-0.50	+0.32	-1.28	-5.54	-5.10	-1.66	-3.02	+5.22	+2.10	+1.92	+3.86	+6.32	+6.34	+5.02	
-10	+0.28	-1.88	-4.92	-5.14	-6.76	-3.04	+0.86	+1.90	+0.20	-1.14	-0.64	0.00	-1.36	-1.68	-4.04	-0.32	+2.76	+1.18	+1.78	+1.88	+1.88	+6.32	+6.32	+3.96	
-20	+0.20	-2.12	-5.32	-6.68	-8.32	-2.52	+0.72	+1.70	-0.06	-0.60	-0.36	-0.36	-2.12	-2.06	-4.02	+0.32	+2.76	+2.44	+0.98	+0.62	+2.68	+5.58	+5.58	+3.28	
-30	+0.28	-1.82	-3.88	-6.64	-8.40	-2.44	0.00	+0.92	+0.06	-0.36	-0.92	-0.90	-2.16	-2.06	-4.02	+1.08	+0.96	+1.40	+0.32	+0.18	+2.36	+4.30	+4.30	+2.68	
-40	+0.36	-1.32	-3.58	-5.78	-7.78	-2.64	-0.94	-0.10	-0.34	-1.14	-1.12	-0.66	+0.02	+0.50	+0.28	+1.36	+1.32	+0.56	-0.10	+0.56	+2.38	+3.46	+3.46	+2.32	
-50	+0.28	-0.88	-2.08	-3.70	-5.04	-2.94	-1.96	-0.82	-0.84	-1.80	-1.14	-0.54	+0.20	+0.76	+1.10	+1.00	+0.66	0.00	+0.92	+2.58	+4.96	+1.32	+2.74	+1.84	
-60	+0.72	-0.30	-1.34	-2.04	-3.26	-2.50	-2.76	-1.28	-1.18	-1.12	-0.96	-3.48	+0.16	+0.54	+0.78	+0.66	+0.20	0.00	+0.28	+1.22	+2.06	+2.84	+2.66	+1.80	
-70	+1.72	0.20	-0.70	-1.22	-1.98	-1.54	-1.74	-1.28	-1.16	-1.10	-0.92	-0.44	-0.06	+0.22	+0.28	+0.36	+0.16	+0.32	+0.84	+1.52	+2.06	+2.84	+2.66	+1.80	
-80	+2.60	0.26	-0.06	-0.10	-0.58	-0.64	-0.72	-0.76	-0.78	-0.74	-0.74	-0.78	-0.66	+0.30	+0.56	+0.70	+0.88	+1.04	+1.24	+1.34	+1.44	+1.44	+1.22	+0.94	



TABLE (47). Secular changes  $\Delta i$  in minutes between 1650-1700 when time is increased by one year. For  $\phi = +90^\circ$ ,  $\delta i = -1.08$ ; for  $\phi = -90^\circ$ ,  $\delta i = +1.02$ .

$\phi$	$\lambda = 0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$
$+90^\circ$	-0.71	-0.79	-0.91	-0.92	-0.92	-0.78	-0.76	-0.50	-0.34	-0.26	-0.16	-0.12	-0.12	-0.16	-0.18	-0.18	-0.16	-0.10	-0.06	-0.06	-0.14	-0.24	-0.42	-0.58
$+75^\circ$	-0.33	-0.30	-0.36	-0.36	-0.36	-0.34	-0.34	-0.16	-0.10	-0.06	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04
$+60^\circ$	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06
$+45^\circ$	-0.18	-0.18	-0.18	-0.18	-0.18	-0.18	-0.18	-0.18	-0.18	-0.18	-0.18	-0.18	-0.18	-0.18	-0.18	-0.18	-0.18	-0.18	-0.18	-0.18	-0.18	-0.18	-0.18	-0.18
$+30^\circ$	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36
$+15^\circ$	-0.54	-0.54	-0.54	-0.54	-0.54	-0.54	-0.54	-0.54	-0.54	-0.54	-0.54	-0.54	-0.54	-0.54	-0.54	-0.54	-0.54	-0.54	-0.54	-0.54	-0.54	-0.54	-0.54	-0.54
$0^\circ$	-0.72	-0.72	-0.72	-0.72	-0.72	-0.72	-0.72	-0.72	-0.72	-0.72	-0.72	-0.72	-0.72	-0.72	-0.72	-0.72	-0.72	-0.72	-0.72	-0.72	-0.72	-0.72	-0.72	-0.72
$-15^\circ$	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90
$-30^\circ$	-1.08	-1.08	-1.08	-1.08	-1.08	-1.08	-1.08	-1.08	-1.08	-1.08	-1.08	-1.08	-1.08	-1.08	-1.08	-1.08	-1.08	-1.08	-1.08	-1.08	-1.08	-1.08	-1.08	-1.08
$-45^\circ$	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26
$-60^\circ$	-1.44	-1.44	-1.44	-1.44	-1.44	-1.44	-1.44	-1.44	-1.44	-1.44	-1.44	-1.44	-1.44	-1.44	-1.44	-1.44	-1.44	-1.44	-1.44	-1.44	-1.44	-1.44	-1.44	-1.44
$-75^\circ$	-1.62	-1.62	-1.62	-1.62	-1.62	-1.62	-1.62	-1.62	-1.62	-1.62	-1.62	-1.62	-1.62	-1.62	-1.62	-1.62	-1.62	-1.62	-1.62	-1.62	-1.62	-1.62	-1.62	-1.62
$-90^\circ$	-1.80	-1.80	-1.80	-1.80	-1.80	-1.80	-1.80	-1.80	-1.80	-1.80	-1.80	-1.80	-1.80	-1.80	-1.80	-1.80	-1.80	-1.80	-1.80	-1.80	-1.80	-1.80	-1.80	-1.80

TABLE (47) Secular changes  $\Delta i$  in minutes between 1700-1780 when time is increased by one year. For  $\phi = +90^\circ$ ,  $\delta i = -1.11$ ; for  $\phi = -90^\circ$ ,  $\delta i = +1.14$ .

$\phi$	$\lambda = 0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$
$+90^\circ$	-1.96	-2.01	-2.11	-2.11	-2.11	-2.06	-2.06	-1.96	-1.86	-1.76	-1.66	-1.56	-1.46	-1.36	-1.26	-1.16	-1.06	-0.96	-0.86	-0.76	-0.66	-0.56	-0.46	-0.36
$+75^\circ$	-1.69	-1.69	-1.69	-1.69	-1.69	-1.69	-1.69	-1.69	-1.69	-1.69	-1.69	-1.69	-1.69	-1.69	-1.69	-1.69	-1.69	-1.69	-1.69	-1.69	-1.69	-1.69	-1.69	-1.69
$+60^\circ$	-1.05	-1.05	-1.05	-1.05	-1.05	-1.05	-1.05	-1.05	-1.05	-1.05	-1.05	-1.05	-1.05	-1.05	-1.05	-1.05	-1.05	-1.05	-1.05	-1.05	-1.05	-1.05	-1.05	-1.05
$+45^\circ$	-0.71	-0.71	-0.71	-0.71	-0.71	-0.71	-0.71	-0.71	-0.71	-0.71	-0.71	-0.71	-0.71	-0.71	-0.71	-0.71	-0.71	-0.71	-0.71	-0.71	-0.71	-0.71	-0.71	-0.71
$+30^\circ$	-0.66	-0.66	-0.66	-0.66	-0.66	-0.66	-0.66	-0.66	-0.66	-0.66	-0.66	-0.66	-0.66	-0.66	-0.66	-0.66	-0.66	-0.66	-0.66	-0.66	-0.66	-0.66	-0.66	-0.66
$+15^\circ$	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98
$0^\circ$	-0.77	-0.77	-0.77	-0.77	-0.77	-0.77	-0.77	-0.77	-0.77	-0.77	-0.77	-0.77	-0.77	-0.77	-0.77	-0.77	-0.77	-0.77	-0.77	-0.77	-0.77	-0.77	-0.77	-0.77
$-15^\circ$	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36
$-30^\circ$	-0.62	-0.62	-0.62	-0.62	-0.62	-0.62	-0.62	-0.62	-0.62	-0.62	-0.62	-0.62	-0.62	-0.62	-0.62	-0.62	-0.62	-0.62	-0.62	-0.62	-0.62	-0.62	-0.62	-0.62
$-45^\circ$	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98
$-60^\circ$	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26	-1.26
$-75^\circ$	-1.54	-1.54	-1.54	-1.54	-1.54	-1.54	-1.54	-1.54	-1.54	-1.54	-1.54	-1.54	-1.54	-1.54	-1.54	-1.54	-1.54	-1.54	-1.54	-1.54	-1.54	-1.54	-1.54	-1.54
$-90^\circ$	-1.82	-1.82	-1.82	-1.82	-1.82	-1.82	-1.82	-1.82	-1.82	-1.82	-1.82	-1.82	-1.82	-1.82	-1.82	-1.82	-1.82	-1.82	-1.82	-1.82	-1.82	-1.82	-1.82	-1.82

Secular changes  $\Delta i$  of inclination i

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TABLE (47) Secular changes  $\Delta i$  in minutes between 1780-1842 when time is increased by one year. For  $\varphi = +90^\circ$ ,  $\Delta i = 0.00$ ; for  $\varphi = -90^\circ$ ,  $\Delta i = -0.64$ .

$\varphi$	$\lambda = 0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$
$+90^\circ$	$+0.77$	$+0.50$	$+0.30$	$+0.15$	$+0.05$	$+0.02$	$+0.01$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$
$+70^\circ$	$+0.67$	$+0.40$	$+0.20$	$+0.10$	$+0.05$	$+0.02$	$+0.01$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$
$+50^\circ$	$+0.57$	$+0.30$	$+0.15$	$+0.07$	$+0.04$	$+0.02$	$+0.01$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$
$+30^\circ$	$+0.47$	$+0.20$	$+0.10$	$+0.05$	$+0.02$	$+0.01$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$
$+10^\circ$	$+0.37$	$+0.15$	$+0.07$	$+0.04$	$+0.02$	$+0.01$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$
$0^\circ$	$+0.27$	$+0.10$	$+0.05$	$+0.02$	$+0.01$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$
$-10^\circ$	$+0.17$	$+0.05$	$+0.02$	$+0.01$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$
$-30^\circ$	$+0.07$	$+0.02$	$+0.01$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$
$-50^\circ$	$-0.03$	$-0.05$	$-0.02$	$-0.01$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$
$-70^\circ$	$-0.13$	$-0.05$	$-0.02$	$-0.01$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$
$-90^\circ$	$-0.23$	$-0.10$	$-0.05$	$-0.02$	$-0.01$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$

TABLE (47) Secular changes  $\Delta i$  in minutes between 1842-1885 when time is increased by one year. For  $\varphi = +90^\circ$ ,  $\Delta i = +0.50$ ; for  $\varphi = -90^\circ$ ,  $\Delta i = +0.95$ .

$\varphi$	$\lambda = 0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$
$+90^\circ$	$+0.52$	$+0.35$	$+0.20$	$+0.10$	$+0.05$	$+0.02$	$+0.01$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$
$+70^\circ$	$+0.42$	$+0.25$	$+0.15$	$+0.07$	$+0.04$	$+0.02$	$+0.01$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$
$+50^\circ$	$+0.32$	$+0.15$	$+0.07$	$+0.04$	$+0.02$	$+0.01$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$
$+30^\circ$	$+0.22$	$+0.10$	$+0.05$	$+0.02$	$+0.01$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$
$+10^\circ$	$+0.12$	$+0.05$	$+0.02$	$+0.01$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$
$0^\circ$	$+0.02$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$	$+0.00$
$-10^\circ$	$-0.08$	$-0.05$	$-0.02$	$-0.01$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$
$-30^\circ$	$-0.18$	$-0.10$	$-0.05$	$-0.02$	$-0.01$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$
$-50^\circ$	$-0.28$	$-0.15$	$-0.07$	$-0.04$	$-0.02$	$-0.01$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$
$-70^\circ$	$-0.38$	$-0.20$	$-0.10$	$-0.05$	$-0.02$	$-0.01$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$
$-90^\circ$	$-0.48$	$-0.30$	$-0.15$	$-0.07$	$-0.04$	$-0.02$	$-0.01$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$	$-0.00$

Secular changes  $\Delta i$  of inclination 1.

TABLE (48). Secular changes  $\Delta T$  of the horizontal intensity T between 1550-1600 when time increases by one year. Unit of the 5th decimal. For  $\phi = +90^\circ$ ,  $\Delta T = -0.00106$ ; for  $\phi = -90^\circ$ ,  $\Delta T = -0.00020$ .

$\lambda = 0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$	
+20°	+2	+34	+60	+68	+48	+4	-52	-104	-136	-160	-176	-188	-194	-190	-178	-170	-170	-160	-134	-54	-54	-54	-27	
+70°	-32	+18	+122	+204	+198	+124	+46	-32	-88	-130	-156	-164	-150	-114	-60	+14	+122	+90	-16	-90	-128	-140	-132	-104
+20°	-148	-58	+104	+274	+324	+264	+176	+32	-20	-70	-104	-114	-90	-62	-12	+12	+28	+38	-36	-130	-192	-218	-212	-192
+70°	-220	-136	+50	+270	+354	+314	+246	+204	+172	+94	-52	-84	-86	-72	-26	-70	-48	-66	-144	-114	-252	-252	-246	
+20°	-316	-170	+10	+234	+314	+264	+224	+224	+180	+88	-16	-56	-32	-26	-66	-102	-98	-90	-130	-192	-238	-252	-260	
+70°	-188	-134	+10	+192	+234	+190	+124	+166	+120	+116	0	-36	+24	+96	-12	-104	-122	-96	-100	-144	-184	-202	-206	
+20°	-104	-58	+48	+172	+138	+20	0	+80	+172	+192	+132	+20	-28	+54	+92	+10	-68	-42	-72	-118	-152	-152	-138	
+70°	-8	+28	+96	+160	+70	-62	-66	+14	+118	+172	+112	+54	-28	+4	+10	-50	-86	-82	-40	-16	-52	-70	-58	
0	+40	+72	+106	+124	+34	-62	-56	+44	+110	+164	+124	+26	-32	-94	-108	-186	-98	-48	-8	0	-20	-36	-2	
-20°	+40	+74	+96	+96	+18	-34	+28	+106	+122	+162	+200	+140	-24	-178	-310	-308	-86	-10	+2	-18	-12	-70	-76	
-70°	+8	+58	+74	+76	+14	-18	+64	+130	+130	+186	+168	+168	0	-182	-354	-186	-50	+12	-74	-52	-32	+6	-14	
-20°	-30	+12	+46	+24	-24	-48	+20	+92	+82	+62	+106	+134	+48	-80	-234	-76	+10	+12	-48	-82	-30	+44	+70	
-70°	-38	-20	-4	-32	-84	-118	-84	-30	-34	-54	+12	+78	+90	+60	+26	+44	+44	-6	-78	-70	+52	+128	+76	
-20°	-76	-70	-110	-164	-204	-208	-184	-120	-172	-154	-78	+30	+112	+164	+140	+114	+56	-18	-66	0	+148	+232	+166	
-70°	+8	-72	-114	-162	-230	-262	-286	-294	-270	-240	-134	+10	+102	+172	+158	+100	+62	-30	-5	+122	+210	+238	+96	
-20°	+16	-50	-114	-172	-234	-266	-294	-308	-312	-282	-190	-64	+48	+104	+108	+84	+56	+50	+108	+212	+256	+100	+134	
-70°	+30	-34	-80	-122	-156	-184	-208	-230	-242	-252	-230	-238	-184	+2	+132	+160	+174	+136	+216	+226	+210	+184	+144	

TABLE (48). Secular changes  $\Delta T$  of the horizontal intensity T between 1600-1650 when time increases by one year. Unit of the 5th decimal. For  $\phi = +90^\circ$ ,  $\Delta T = -0.00014$ ; for  $\phi = -90^\circ$ ,  $\Delta T = +0.00068$ .

$\lambda = 0^\circ$	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°	195°	210°	225°	240°	255°	270°	285°	300°	315°	330°	345°	
+20°	+28	+120	+162	+170	+146	+88	+24	-40	-92	-126	-136	-130	-104	-80	-52	-26	-70	-58	-86	-82	-74	-56	-26	+16
+70°	+20	+128	+232	+324	+314	+236	+124	+20	-56	-92	-94	-82	-48	-18	+36	+66	+30	-44	-134	-180	-196	-174	-124	-64
+20°	-68	+68	+256	+392	+404	+332	+220	+120	+44	+8	-2	-6	+2	+8	+10	-20	-58	-120	-200	-262	-288	-260	-214	-158
+70°	-148	-74	+188	+364	+398	+356	+252	+152	+84	+30	+34	+64	+52	+28	+6	-78	-152	-192	-232	-270	-302	-286	-262	-214
+20°	-154	-60	+114	+274	+322	+274	+158	+74	+166	+200	+144	+70	+80	+168	+118	+18	-126	-184	-216	-258	-292	-260	-240	-202
+70°	-112	-44	+80	+192	+192	+116	-4	-74	+166	+200	+144	+70	+80	+168	+118	+18	-126	-184	-216	-258	-292	-260	-240	-202
+20°	-26	+74	+88	+116	-8	-232	-222	-118	+18	+112	+116	+40	+10	+96	+114	+42	-10	-34	+128	+74	+64	-6	-42	0
+70°	+32	+78	+112	+78	-130	-218	-160	-70	+34	+100	+134	+62	-44	-68	-84	-78	-20	+56	+114	+130	+102	+34	-14	+78
0	+70	+90	+86	+26	-130	-218	-160	-70	+34	+100	+134	+62	-44	-68	-84	-78	-20	+56	+114	+130	+102	+34	-14	+78
-20°	+36	+78	+52	-14	-124	-144	-28	-54	+84	+106	+144	+86	-82	-208	-260	-164	-8	+126	+160	+140	+102	+32	-38	-14
-70°	-34	-4	+6	-36	-104	-70	+78	+158	+126	+94	+114	+64	-94	-264	-236	-156	+50	+178	+158	+98	+82	+32	-38	-62
-20°	-90	-52	-26	-58	-104	-66	+24	+174	+124	+48	+52	+46	-48	-164	-174	-42	+116	+172	+110	+50	+80	+56	-36	-100
-70°	-162	-76	-76	-104	-156	-128	-10	+46	+30	-56	-54	-2	-10	-32	0	+84	+150	+128	+48	+56	+142	+138	+10	-82
-20°	-70	-92	-118	-152	-192	-186	-118	-60	-72	-136	-132	-52	+30	+82	+122	+138	+116	+54	+30	+114	+240	+248	+142	+4
-70°	-10	-62	-126	-186	-218	-246	-218	-174	-174	-150	-72	+34	+88	+130	+118	+56	+28	+58	+182	+112	+206	+214	+96	+36
-20°	+48	-36	-108	-170	-204	-234	-280	-202	-196	-168	-78	-6	+48	+58	+38	+66	+152	+262	+216	+318	+244	+144	+144	+144
-70°	+82	+128	-20	-56	-88	-118	-130	-142	-132	-142	-150	-124	+56	+106	+134	+166	+138	+230	+246	+248	+238	+190	+138	+138

TABLE (48). Secular changes  $\Delta T$  of horizontal intensity T between 1650-1700 in units of 5th decimal when time is increased by one year. For  $\phi = +90^\circ$ ,  $\Delta T = +0.00183$ ; for  $\phi = -90^\circ$ ,  $\Delta T = +0.00178$

251	+002	+722	+421	+702	+904	+013	+734	+824	+014	+204	+281	+842	+821	-741	-881	-701	-78	-85	-45	-8	-82	+42	+20	+02
82	+091	+732	+835	+874	+024	+451	+722	+861	+751	+801	+74	+881	-053	-054	-735	-522	-881	-051	-841	-211	-78	-84	-81	+62
014	+111	+432	+951	+724	+823	+978	+971	+221	+901	+94	+974	+02	-441	-815	-915	-748	-705	-175	-833	-323	-781	-81	-72	+07
45	+01	+771	+021	+505	+723	+872	+821	+82	+92	+98	+25	+05	-041	-991	-721	-741	-822	-462	-242	-242	-741	-211	-05	-04
75	-2	+021	+822	+723	+023	+841	+86	+29	+3	+3	+4	+72	+2	+73	+92	+91	+04	-022	-431	-431	-042	-251	-05	-04
41	-4	+02	+402	+822	+081	+86	+45	+2	+2	-72	-471	-291	+44	+712	+161	+474	+044	+071	-742	-342	-161	-72	-05	
81	+4	+02	+011	+441	+72	+71	+82	-74	-82	-82	-251	+05	+712	+012	+022	+422	+022	+021	-431	-431	-901	+4	+04	
91	-2	-4	-4	+42	+01	-4	-82	-74	-74	-205	-702	+8	+8	+922	+722	+212	+021	+8	+03	-802	-551	-01	+47	+0
82	-26	-441	-2	-02	-77	-47	-47	-981	-742	-421	-22	+411	+21	+442	+422	+322	+422	+09	+28	-41	-79	+7	+2	+0
711	-421	-452	-022	-481	-401	-45	-22	-41	-02	-02	-02	-02	-02	-02	-02	-02	-02	-02	-02	-02	-02	-02	-02	-02
981	-752	-222	-942	-872	-431	-03	-71	+02	+02	+02	+04	+2	-71	+04	+22	+02	+02	+48	+22	+34	+34	+02	-02	-02
022	-722	-452	-442	-832	-021	-03	-72	+74	+74	+78	+42	+42	-72	-48	-02	-02	-02	+48	+32	+26	+26	+42	-02	-02
021	-822	-702	-262	-252	-842	-28	-22	+22	+02	+32	+42	-4	-82	-251	-831	-021	-02	+82	+30	+76	+76	+84	-02	-02
55	-711	-771	-982	-242	-202	-121	-2	+01	+22	+22	+22	+74	-72	-431	-471	-811	-02	+29	+28	+34	+28	+28	-02	-02
821	-21	-26	-871	-222	-212	-22	-48	+48	+40	+42	+42	+42	+8	-25	-86	-411	-02	+42	+22	+32	+28	+28	-02	-02
974	+21	-71	-02	-452	-492	-831	-251	+25	+42	+42	+42	+42	+8	-25	-86	-411	-02	+42	+22	+32	+28	+28	-02	-02
264	+21	-41	-42	-74	-4	-2	-2	+42	+42	+42	+42	+42	+8	-25	-86	-411	-02	+42	+22	+32	+28	+28	-02	-02
521	-012	-521	-002	-522	-222	-042	-522	+922	+22	+22	+22	+42	+42	+251	+311	+201	+06	-524	-02	-54	-02	-51	-02	-02

TABLE (48). Secular changes  $\Delta T$  of horizontal intensity T between 1700-1780 in units of 5th decimal when time is increased by one year. For  $\phi = +90^\circ$ ,  $\Delta T = +0.00175$ ; for  $\phi = -90^\circ$ ,  $\Delta T = +0.00170$

$\lambda$	0°	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°	195°	210°	225°	240°	255°	270°	285°	300°	315°	330°	345°
+80°	+157	+166	+171	+179	+180	+7	-81	-154	-188	-194	-177	-150	-116	-74	-41	-130	+127	+208	+211	+216	+223	+231	+240	+245
+70°	+152	+162	+175	+180	+177	+21	-101	-178	-230	-230	-191	-159	-119	-60	-17	-59	-216	-282	-326	-342	-349	-360	+105	+105
+60°	+143	+155	+174	+184	+182	+1	-85	-136	-211	-216	-161	-128	-91	-47	-13	-2	-204	-333	-374	-383	-397	-410	-421	-428
+50°	+139	+153	+175	+189	+188	+10	-12	-120	-206	-214	-159	-128	-94	-51	-19	-5	-156	-276	-320	-335	-351	-364	-374	-378
+40°	+131	+147	+172	+190	+190	+25	+35	+48	+91	+150	+189	+218	+254	+266	+283	+292	-107	-236	-270	-285	-300	-314	-324	-328
+30°	+121	+139	+167	+197	+200	+45	+44	+56	+80	+99	+94	+92	+102	+104	+76	+32	-12	-75	-167	-219	-235	-250	-260	-264
+20°	+114	+134	+165	+200	+206	+61	+57	+54	+50	+42	+31	+24	+26	+25	+17	+7	-47	-115	-177	-219	-237	-252	-264	-268
+10°	+108	+130	+164	+202	+210	+87	+106	+92	+71	+51	+34	+26	+28	+28	+20	+11	-62	-142	-197	-239	-258	-274	-287	-291
0	+103	+126	+162	+203	+212	+120	+128	+106	+76	+55	+38	+31	+33	+33	+25	+16	-72	-154	-203	-245	-265	-282	-296	-300
-10°	+98	+121	+158	+200	+210	+130	+138	+116	+86	+64	+47	+40	+42	+42	+34	+25	-82	-167	-210	-252	-273	-290	-304	-308
-20°	+94	+117	+155	+199	+210	+136	+144	+122	+92	+70	+53	+46	+48	+48	+40	+31	-90	-178	-224	-267	-289	-307	-321	-325
-30°	+90	+114	+153	+198	+210	+143	+151	+129	+98	+76	+59	+52	+54	+54	+46	+37	-98	-189	-238	-282	-305	-324	-338	-342
-40°	+86	+110	+150	+200	+212	+150	+158	+136	+105	+83	+66	+59	+61	+61	+53	+44	-106	-202	-253	-298	-322	-342	-357	-361
-50°	+83	+107	+148	+200	+213	+157	+165	+144	+113	+91	+74	+67	+69	+69	+61	+52	-114	-216	-269	-315	-340	-360	-375	-379
-60°	+80	+104	+146	+200	+215	+163	+171	+150	+119	+97	+80	+73	+75	+75	+67	+58	-122	-228	-283	-330	-356	-377	-392	-396
-70°	+78	+102	+145	+200	+218	+168	+176	+156	+125	+103	+86	+79	+81	+81	+73	+64	-130	-238	-295	-343	-370	-392	-407	-411
-80°	+76	+100	+143	+200	+221	+173	+181	+162	+131	+109	+92	+85	+87	+87	+79	+70	-138	-248	-307	-356	-384	-407	-422	-426
-90°	+75	+99	+142	+200	+224	+177	+185	+166	+135	+113	+96	+89	+91	+91	+83	+74	-146	-259	-319	-369	-400	-423	-438	-442
-100°	+74	+98	+141	+200	+227	+180	+188	+170	+138	+116	+99	+92	+94	+94	+86	+77	-154	-270	-331	-382	-414	-437	-452	-456
-110°	+73	+97	+140	+200	+230	+183	+191	+174	+141	+119	+102	+95	+97	+97	+89	+80	-162	-282	-344	-396	-429	-452	-467	-471
-120°	+72	+96	+139	+200	+233	+186	+194	+178	+145	+123	+106	+99	+101	+101	+93	+84	-170	-295	-358	-411	-445	-468	-483	-487
-130°	+71	+95	+138	+200	+236	+189	+197	+181	+148	+126	+109	+102	+104	+104	+96	+87	-178	-308	-372	-426	-461	-484	-499	-503
-140°	+70	+94	+137	+200	+239	+192	+200	+185	+151	+129	+112	+105	+107	+107	+99	+90	-186	-322	-387	-442	-477	-500	-515	-519
-150°	+69	+93	+136	+200	+242	+195	+203	+188	+154	+132	+115	+108	+110	+110	+102	+93	-194	-336	-402	-457	-492	-515	-530	-534
-160°	+68	+92	+135	+200	+245	+198	+206	+191	+157	+135	+118	+111	+113	+113	+105	+96	-202	-350	-416	-471	-506	-529	-544	-548
-170°	+67	+91	+134	+200	+248	+201	+209	+194	+160	+138	+121	+114	+116	+116	+108	+99	-210	-364	-430	-485	-520	-543	-558	-562
-180°	+66	+90	+133	+200	+251	+204	+212	+197	+163	+141	+124	+117	+119	+119	+111	+102	-218	-378	-444	-499	-534	-557	-572	-576
-190°	+65	+89	+132	+200	+254	+207	+215	+200	+166	+144	+127	+120	+122	+122	+114	+105	-226	-392	-458	-513	-548	-571	-586	-590
-200°	+64	+88	+131	+200	+257	+210	+218	+203	+169	+147	+130	+123	+125	+125	+117	+108	-234	-406	-472	-527	-562	-585	-600	-604
-210°	+63	+87	+130	+200	+260	+213	+221	+206	+172	+150	+133	+126	+128	+128	+120	+111	-242	-420	-486	-541	-576	-600	-615	-619
-220°	+62	+86	+129	+200	+263	+216	+224	+209	+175	+153	+136	+129	+131	+131	+123	+114	-250	-434	-500	-555	-590	-614	-629	-633
-230°	+61	+85	+128	+200	+266	+219	+227	+212	+178	+156	+139	+132	+134	+134	+126	+117	-258	-448	-514	-569	-604	-628	-643	-647
-240°	+60	+84	+127	+200	+269	+222	+230	+215	+181	+159	+142	+135	+137	+137	+129	+120	-266	-462	-528	-583	-618	-642	-657	-661
-250°	+59	+83	+126	+200	+272	+225	+234	+218	+184	+162	+145	+138	+140	+140	+132	+123	-274	-476	-542	-597	-632	-656	-671	-675
-260°	+58	+82	+125	+200	+275	+228	+237	+221	+187	+165	+148	+141	+143	+143	+135	+126	-282	-490	-556	-611	-646	-670	-685	-689
-270°	+57	+81	+124	+200	+278	+231	+240	+224	+190	+168	+151	+144	+146	+146	+138	+129	-290	-504	-570	-625	-660	-684	-699	-703
-280°	+56	+80	+123	+200	+281	+234	+243	+228	+193	+171	+154	+147	+149	+149	+141	+132	-298	-518	-584	-639	-674	-698	-713	-717
-290°	+55	+79	+122	+200	+284	+237	+246	+231	+196	+174	+157	+150	+152	+152	+144	+135	-306	-532	-598	-653	-688	-712	-727	-731
-300°	+54	+78	+121	+200	+287	+240	+249	+234	+199	+177	+160	+153	+155	+155	+147	+138	-314	-546	-612	-667	-702	-726	-741	-745
-310°	+53	+77	+120	+200	+290	+243	+252	+237	+202	+180	+163	+156	+158	+158	+150	+141	-322	-560	-626	-681	-716	-740	-755	-759
-320°	+52	+76	+119	+200	+293	+246	+255	+240	+205	+183	+166	+159	+161	+161	+153	+144	-330	-574	-640	-695	-730	-754	-769	-773
-330°	+51	+75	+118	+200	+296	+249	+258	+243	+208	+186	+169	+162	+164	+164	+156	+147	-338	-588	-654	-709	-744	-768	-783	-787
-340°	+50	+74	+117	+200	+299	+252	+261	+246	+211	+189	+172	+165	+167	+167	+159	+150	-346	-602	-668	-723	-758	-782	-797	-801
-350°	+49	+73	+116	+200	+302	+255	+264	+249	+214	+192	+175	+168	+170	+170	+162	+153	-354	-616	-682	-737	-772	-796	-811	-815
-360°	+48	+72	+115	+200	+305	+258	+267	+252	+217	+195	+178	+171	+173	+173	+165	+156	-362	-630	-696	-751	-786	-810	-825	-829
-370°	+47	+71	+114	+200	+308	+261	+270	+255	+220	+198	+181	+174	+176	+176	+168	+159	-370	-644	-710	-765	-800	-824	-839	-843
-380°	+46	+70	+113	+200	+311	+264	+273	+258	+223	+201	+184	+177	+179	+179	+171	+162	-378	-658	-724	-779	-814	-838	-853	-857
-390°	+45	+69	+112	+200	+314	+267	+276	+261	+226	+204	+187	+180	+182	+182	+174	+165	-386	-672	-738	-793	-828	-852	-867	-871
-400°	+44	+68	+111	+200	+317	+270	+279	+264	+229	+207	+190	+183	+185	+185	+177	+168	-394	-686	-752	-807	-842	-866	-881	-885
-410°	+43	+67	+110	+200	+320	+273	+282	+267	+232	+210	+193	+186	+188	+188	+180	+171	-402	-699	-766	-821	-856	-880	-895	-899
-420°	+42	+66	+109	+200	+323	+276	+285	+270	+235	+213	+196	+189	+191	+191	+183	+174	-410	-713	-780	-835	-870	-894	-909	-913
-430°	+41	+65	+108	+200	+326	+279	+288	+273	+238	+216	+199	+192	+194	+194	+186	+177	-418	-727	-794	-849	-884	-908	-923	-927
-440°	+40	+64	+107	+200	+329	+282	+291	+276	+241	+219	+202	+195	+197	+197	+189	+180	-426	-740	-808	-863	-898	-922	-937	-941
-450°	+39	+63	+106	+200	+332	+285	+294	+279	+244	+222	+205	+198	+200	+200	+192	+183	-434	-754	-822	-877	-912	-936	-951	-955
-460°	+38	+62	+105	+200	+335	+288	+297	+282	+247	+225	+208	+201	+203	+203	+195	+186	-442	-768	-836	-891	-926	-950	-965	-969
-470°	+37	+61	+104	+200	+338	+291	+300	+285	+250	+228	+211	+204	+206	+206	+198	+189	-450	-781	-850	-905	-940	-964	-979	-983
-480°	+36	+60	+103	+200	+341	+294	+303	+288	+253	+231	+214	+207	+209	+209	+201	+192	-458	-795	-864	-919	-954	-978	-993	-997
-490°	+35	+59	+102	+200	+344	+297	+306	+291	+256	+234	+217	+210	+212	+212	+204	+195	-466	-809	-878	-933	-968	-992	-1007	-1011
-500°	+34	+58	+101	+200	+347	+300	+309	+294	+259	+237	+220	+213	+215	+215	+207	+198	-474	-822	-892	-947	-982	-1006	-1021	-1025
-510°	+33	+57	+100	+200	+350	+303	+312	+297	+262	+240	+223	+216	+218	+218	+210	+201	-482	-836	-906	-961	-996	-1020	-1035	-1039
-520°	+32	+56	+99	+200	+353	+306	+315	+300	+265	+243	+226	+219	+221	+221	+213									



TABLE (48). Secular changes  $\Delta T$  of horizontal intensity T between 1780-1842 in units of 5th decimal when time is increased by one year. For  $q' = +90^\circ$ ,  $\Delta T = +0.00005$ ; for  $q' = -90^\circ$ ,  $\Delta T = -0.00074$ .

$q'$	$\lambda = 0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$	
+80°	+73	+15	+90	+89	+84	+79	+73	+66	+63	+58	+50	+43	+34	+25	+16	+8	+26	+24	+26	+26	+26	+26	+26	+26	+26
+70°	+199	+190	+163	+129	+81	+34	-10	-48	-68	-84	-106	-126	-143	-159	-173	-183	-189	-193	-195	-195	-195	-195	-195	-195	-195
+60°	+325	+287	+199	+92	-174	-261	-342	-384	-418	-444	-464	-480	-492	-500	-505	-508	-510	-511	-511	-511	-511	-511	-511	-511	-511
+50°	+494	+352	+204	+29	-134	-261	-342	-384	-418	-444	-464	-480	-492	-500	-505	-508	-510	-511	-511	-511	-511	-511	-511	-511	-511
+40°	+577	+428	+266	+31	-164	-284	-345	-373	-396	-411	-427	-444	-464	-480	-492	-500	-510	-511	-511	-511	-511	-511	-511	-511	-511
+30°	+589	+503	+303	+76	-84	-156	-190	-211	-217	-217	-217	-217	-217	-217	-217	-217	-217	-217	-217	-217	-217	-217	-217	-217	-217
+20°	+578	+477	+280	+108	+32	+81	+113	+118	+118	+118	+118	+118	+118	+118	+118	+118	+118	+118	+118	+118	+118	+118	+118	+118	+118
+10°	+443	+282	+110	+47	+94	+153	+203	+218	+218	+218	+218	+218	+218	+218	+218	+218	+218	+218	+218	+218	+218	+218	+218	+218	+218
0°	+113	-48	-158	-81	+85	+203	+262	+306	+323	+323	+323	+323	+323	+323	+323	+323	+323	+323	+323	+323	+323	+323	+323	+323	+323
-10°	-127	-328	-441	-250	+15	+169	+250	+301	+325	+325	+325	+325	+325	+325	+325	+325	+325	+325	+325	+325	+325	+325	+325	+325	+325
-20°	-449	-607	-595	-344	-50	+118	+187	+244	+282	+285	+271	+230	+201	+169	+133	+85	+28	+26	+26	+26	+26	+26	+26	+26	+26
-30°	-454	-581	-545	-321	-71	+76	+129	+161	+177	+199	+193	+151	+101	+51	+27	+21	+21	+21	+21	+21	+21	+21	+21	+21	+21
-40°	-248	-350	-325	-182	-13	+50	+118	+144	+124	+124	+111	+98	+90	+97	+123	+120	+124	+124	+124	+124	+124	+124	+124	+124	+124
-50°	+23	-61	-69	-13	+61	+105	+119	+123	+113	+100	+77	+63	+56	+61	+103	+191	+311	+443	+521	+542	+519	+440	+316	+166	+166
-60°	+225	+148	+103	+87	+94	+95	+98	+110	+127	+140	+114	+90	+76	+84	+118	+196	+298	+398	+469	+511	+522	+492	+419	+326	+326
-70°	+252	+198	+144	+106	+77	+48	+29	+13	+27	+40	+131	+69	+50	+55	+71	+110	+164	+228	+285	+334	+361	+365	+345	+298	+298
-80°	+115	+95	+65	+31	+5	-26	-61	-92	-124	-158	-185	-190	-171	-135	-105	-66	-26	-15	+56	+90	+119	+137	+142	+134	+134

TABLE (48). Secular changes  $\Delta T$  of horizontal intensity T between 1842-1885 in units of 5th decimal when time is increased by one year. For  $q' = +90^\circ$ ,  $\Delta T = -0.00318$ ; for  $q' = -90^\circ$ ,  $\Delta T = +0.00243$ .

$q'$	$\lambda = 0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$	
+80°	-119	-144	-161	-186	-203	-230	-241	-257	-253	-239	-203	-172	-133	-105	-72	-40	-14	+22	+12	+16	+37	+49	+70	+70	+70
+70°	-79	-131	-177	-219	-257	-300	-346	-366	-346	-300	-221	-177	-139	-112	-86	-58	-34	-15	+23	+28	+30	+19	+2	+2	+2
+60°	+14	-52	-133	-196	-262	-325	-373	-383	-346	-271	-226	-186	-159	-135	-121	-110	-105	-119	+16	+14	+105	+133	+123	+87	+87
+50°	+135	+58	-23	-110	-184	-241	-285	-302	-278	-239	-191	-168	-142	-133	-137	-147	-159	-161	-146	+119	+234	+241	+194	+194	+194
+40°	+198	+137	+65	-12	-77	-131	-156	-177	-179	-170	-151	-123	-86	-56	-25	-110	-151	-186	-198	-168	+56	+209	+266	+249	+249
+30°	+172	+151	+102	+49	+13	+2	+2	+16	+67	+114	+137	+110	-40	+16	+74	-37	-107	-161	-196	-168	+127	+184	+203	+203	+203
+20°	+72	+21	+90	+79	+83	+110	+167	+144	+79	-7	-79	-79	-7	+65	+93	+52	-12	-90	-166	-193	-151	-47	-24	+81	+81
+10°	-52	-28	-18	+88	+151	+216	+278	+278	+219	+116	+19	-44	-28	+30	+45	+58	+13	-54	-156	-253	-328	-314	-116	-61	-61
0°	-170	-144	-67	+61	+174	+265	+325	+341	+316	+228	+109	-37	-100	-97	-79	-67	-67	-112	-181	-302	-425	-380	-263	-179	-179
-10°	-348	-221	-116	+37	+157	+209	+226	+234	+214	+102	-56	-105	-183	-285	-360	-439	-471	-486	-496	-505	-511	-511	-511	-511	-511
-20°	-348	-273	-179	-58	+19	+31	-12	-23	+5	+32	-7	-33	-283	-386	-433	-406	-397	-418	-495	-610	-739	-704	-535	-363	-363
-30°	-348	-332	-283	-221	-191	-191	-319	-318	-341	-320	-217	-172	-103	-271	-383	-404	-411	-419	-474	-588	-704	-706	-563	-404	-404
-40°	-366	-388	-404	-395	-400	-409	-429	-429	-429	-429	-429	-429	-429	-429	-429	-429	-429	-429	-429	-429	-429	-429	-429	-429	-429
-50°	-323	-406	-479	-504	-500	-465	-439	-425	-413	-378	-335	-284	-231	-188	-148	-108	-71	-23	+23	+86	+170	+209	+143	+2	+2
-60°	-224	-339	-425	-446	-416	-331	-224	-123	-86	-144	-174	-128	-47	+37	+110	+201	+318	+459	+523	+488	+360	+203	+49	+88	+88
-70°	-83	-193	-262	-276	-239	-161	-44	+79	+174	+209	-44	-735	-90	-37	+114	+253	+400	+520	+572	+528	+346	+166	+193	+116	+116
-80°	+77	-12	-94	-61	-35	-3	+40	+56	+49	+7	-28	-25	+23	+105	+182	+260	+318	+346	+346	+346	+346	+346	+346	+346	+346

ORIGINAL PAGE 13  
OF POOR QUALITY



TABLE (49). Secular changes  $\Delta I$  of the total intensity I in units of the 5th decimal between 1550-1600 when the time is increased by one year. For  $\varphi = +90^\circ$ ,  $\Delta J = +0.00066$ ; for  $\varphi = -90^\circ$ ,  $\Delta J = -0.00036$ .

$\varphi$	$\lambda=0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$
+80	+56	+64	+92	+106	+134	+168	+192	+212	+214	+200	+166	+120	+72	+16	-28	-56	-84	-92	-88	-70	-48	-20	+8	+36
+70	+20	+18	+18	+38	+80	+132	+238	+310	+352	+332	+274	+172	+62	+52	-128	-196	-234	-232	-168	-112	-50	-10	+14	+70
+60	+22	-26	-34	-56	-60	+34	+182	+330	+416	+418	+330	+180	+58	-62	-158	-238	-300	-310	-272	-192	-92	-5	+50	+54
+50	+70	-14	-186	-222	-250	-176	+48	+252	+390	+472	+342	+206	+76	-40	-118	-190	-248	-254	-274	-180	-40	+80	+130	+118
+40	+148	+42	-118	-254	-368	-282	-82	+142	+300	+344	+304	+198	+36	+8	-54	-104	-182	-240	-246	-144	+18	+158	+268	+198
+30	+234	+114	-64	-102	-404	-334	-148	+46	+188	+232	+246	+180	+92	+18	-16	-40	-98	-168	-184	-102	+52	+198	+270	+270
+20	+256	+160	-38	-240	-334	-272	-124	+32	+140	+192	+196	+160	+80	-12	-52	-42	-60	-102	-116	-58	+60	+134	+264	+286
+10	+230	+166	+8	-146	-186	-120	-46	+28	+126	+178	+172	+120	+38	-76	-114	-84	-66	-64	-58	-16	+44	+132	+296	+230
0	+132	+126	+46	-10	+30	+80	+62	+82	+164	+204	+154	+62	-16	-120	-158	-132	-106	-58	0	+14	-70	-20	+26	+34
-10	+12	+70	+38	+154	+244	+258	+166	+150	+222	+264	+180	+34	-78	-164	-198	-192	-148	-50	+54	+44	-80	-152	-178	-88
-20	-104	+34	+150	+300	+420	+296	+256	+312	+340	+234	+42	+2	-126	-228	-268	-252	-170	-24	+92	+40	-166	-350	-370	-256
-30	-194	-4	+186	+372	+498	+422	+402	+352	+374	+376	+264	+44	-144	-280	-324	-286	-198	+6	+96	-8	-266	-482	-518	-388
-40	-254	-30	+188	+380	+510	+524	+464	+402	+388	+358	+246	+58	-138	-276	-312	-244	-158	+44	+78	-110	-326	-536	-578	-460
-50	-264	-52	+146	+324	+440	+466	+426	+380	+336	+284	+188	+50	-98	-196	-210	-146	-36	+50	+24	-184	-344	-512	-558	-444
-60	-244	-84	+86	+224	+302	+342	+322	+276	+218	+190	+116	+42	-42	-90	-96	-58	0	+18	-34	-150	-298	-406	-442	-386
-70	-178	-80	+24	+102	+158	+180	+182	+174	+138	+106	+62	+26	-14	-32	-32	-24	-18	-34	-80	-144	-222	-274	-294	-266
-80	-102	-70	-70	0	+22	+40	+50	+48	+42	+26	+22	+10	-6	-16	-20	-28	-44	-58	-78	-102	-122	-132	-138	-126

TABLE (49). Secular changes  $\Delta I$  of the total intensity I in units of the 5th decimal between 1600-1650 when the time is increased by one year. For  $\varphi = +90^\circ$ ,  $\Delta J = +0.00088$ ; for  $\varphi = -90^\circ$ ,  $\Delta J = -0.00038$ .

$\varphi$	$\lambda=0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$
+80	+50	+62	+76	+98	+116	+162	+198	+220	+228	+214	+184	+144	+88	+40	-6	-34	-52	-50	-38	-22	-4	+16	+28	+40
+70	+12	-38	-44	-16	+42	+134	+242	+330	+364	+358	+280	+178	+66	-34	-114	-156	-170	-156	-118	-56	+6	+34	+44	+26
+60	-30	-122	-194	-228	-178	-26	+160	+332	+426	+422	+334	+184	+32	-84	-152	-198	-196	-174	-114	-20	+68	+124	+108	+50
+50	-14	-156	-332	-390	-376	-226	+16	+216	+402	+412	+308	+160	+10	-56	-90	-106	-118	-104	-46	+64	+174	+234	+202	+104
+40	+68	-96	-234	-466	-514	-388	-146	+124	+290	+326	+246	+120	-2	-68	-26	-2	+4	-8	+32	+138	+272	+342	+312	+204
+30	+132	-10	-258	-470	-528	-450	-224	+8	+156	+200	+160	+78	-14	-50	-10	+64	+102	+96	+104	+188	+316	+396	+362	+270
+20	+170	+28	-186	-398	-466	-378	-230	-64	+58	+130	+112	+58	-36	-106	-66	+56	+126	+110	+128	+188	+302	+380	+370	+280
+10	+164	+60	-100	-254	-376	-342	-212	-124	+20	+114	+110	+54	-58	-154	-132	-2	+72	+100	+122	+156	+224	+272	+274	+228
0	+106	+58	-34	-70	-74	-24	-188	-150	+30	+158	+152	+58	-56	-134	-156	-84	-30	+28	+30	+172	+90	+88	+104	+116
-10	+34	+62	+74	+124	+160	+48	-112	-106	+82	+232	+118	+96	-38	-120	-152	-142	-126	-26	+80	+86	-32	-132	-130	-44
-20	+42	+58	+156	+274	+322	+204	+18	-6	+160	+312	+298	+130	-42	-148	-192	-208	-152	-4	+116	+64	-146	-124	-530	-190
-30	-124	+34	+210	+348	+414	+314	+166	+128	+240	+352	+332	+162	-30	-178	-244	-230	-118	+50	+42	+18	-240	-566	-490	-354
-40	-188	+34	+214	+364	+422	+372	+262	+208	+250	+318	+298	+160	-32	-172	-236	-172	-30	+114	+32	-30	-316	-540	-576	-424
-50	-228	-18	+168	+302	+368	+336	+274	+218	+224	+242	+224	+124	-8	-102	-130	-64	+42	+120	+94	-80	-326	-512	-544	-434
-60	-226	-56	+92	+190	+248	+234	+202	+180	+160	+150	+126	+72	+76	-26	-18	+30	+82	+102	+40	-104	-276	-410	-448	-166
-70	-176	-98	-16	+56	+104	+112	+104	+82	+78	+68	+60	+44	+34	+30	+38	+50	+62	+44	-8	-96	-294	-256	-272	-242
-80	-106	-74	-38	-12	+6	+20	+16	+16	+14	+16	+12	+6	+12	+10	+10	+10	+8	-16	-42	-78	-106	-132	-138	-128

ORIGINAL PAGE 13  
OF POOR QUALITY

TABLE (49). Secular changes  $\Delta I$  of the total intensity I in units of the 5th decimal between 1650-1700 when the time is increased by one year. For  $\varphi = +90^\circ$ ,  $\Delta J = -0.00030$ ; for  $\varphi = -90^\circ$ ,  $\Delta J = -0.00086$ .

$\varphi$	$\lambda = 0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$	
$+90^\circ$	-14	-24	-30	-34	-48	-52	-76	-90	-96	-102	-96	-86	-54	-34	-26	+12	+68	+76	+82	+76	+62	+36	+20	-2	-14
$+70$	-30	-46	-46	-42	-28	-30	-52	-96	-122	-166	-166	-140	-80	-2	+86	+152	+204	+222	+216	+180	+126	+76	+24	-14	-50
$+60$	-98	-128	-134	-92	-18	+32	+34	-12	-102	-170	-194	-166	-94	+8	+82	+234	+304	+352	+334	+274	+180	+84	+2	-50	-50
$+50$	-136	-220	-272	-234	-70	+86	+144	+52	-22	-106	-160	-162	-112	-44	+8	+82	+336	+408	+430	+360	+256	+174	+14	-56	-56
$+40$	-152	-308	-446	-406	-176	+100	+244	+206	+88	-14	-88	+78	200	-162	-26	+164	+306	+396	+442	+428	+332	+174	+14	-56	-56
$+30$	-88	-322	-536	-510	-234	+104	+374	+256	+176	+30	-4	-136	-278	-312	-170	+40	+324	+414	+462	+392	+244	+110	+20	-20	-20
$+20$	-6	-262	-508	-500	-204	+104	+422	+276	+214	+142	+54	-118	-330	-408	-278	-82	+98	+204	+316	+400	+386	+280	+162	+106	+106
$+10$	+60	-148	-358	-298	-40	+160	+344	+280	+258	+192	+98	-84	-298	-402	-304	-140	-14	+72	+148	+220	+244	+212	+158	+140	+140
$0$	+82	-30	-88	+36	+204	+348	+252	+308	+316	+266	+146	-6	-196	-302	-268	-184	-106	-74	-70	-18	+40	+80	+102	+102	+102
$-10$	+60	+78	+170	+338	+442	+236	+286	+376	+426	+376	+238	+74	-84	-192	-222	-206	-168	-198	-286	-378	-332	-192	-50	+54	+54
$-20$	+12	+140	+316	+470	+482	+378	+342	+428	+516	+484	+328	+148	-16	-140	-202	-202	-196	-266	-426	-566	-554	-404	-214	-92	-92
$-30$	-38	+132	+330	+476	+400	+396	+358	+406	+506	+466	+358	+218	+8	-126	-168	-168	-176	-272	-468	-632	-656	-528	-302	-180	-180
$-40$	-110	+58	+216	+362	+396	+388	+436	+552	+662	+640	+484	+218	+8	-80	-120	-126	-156	-272	-442	-600	-642	-564	-418	-264	-264
$-50$	-192	-34	+120	+238	+308	+368	+440	+558	+620	+596	+444	+276	+98	-32	-74	-96	-130	-240	-396	-534	-584	-552	-456	-326	-326
$-60$	-236	-118	0	+114	+208	+296	+378	+452	+490	+472	+380	+248	+118	+18	-38	-90	-146	-238	-348	-446	-494	-486	-444	-338	-338
$-70$	-238	-144	-54	+36	+104	+190	+254	+304	+320	+302	+248	+174	+92	+18	-40	-98	-160	-218	-290	-346	-378	-382	-354	-304	-304
$-80$	-176	-138	-92	-48	+2	+40	+82	+106	+116	+118	+80	+56	+18	-32	-64	-102	-142	-176	-206	-238	-242	-246	-238	-210	-210

TABLE (49). Secular changes  $\Delta I$  of the total intensity I in units of the 5th decimal between 1700-1780 when the time is increased by one year. For  $\varphi = +90^\circ$ ,  $\Delta J = -0.00191$ ; for  $\varphi = -90^\circ$ ,  $\Delta J = -0.00200$ .

$\varphi$	$\lambda = 0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$	
$+80^\circ$	-408	-740	-368	-312	-242	-166	-89	-22	+17	+41	+51	+27	0	-26	-56	-89	-119	-149	-182	-231	-275	-319	-363	-389	
$+70$	-537	-760	-524	-454	-376	-296	-177	+241	+277	+217	+152	+82	+27	-11	-25	-37	-55	-86	-135	-193	-276	-368	-466		
$+60$	-512	-606	-591	-475	-379	-279	-174	+321	+392	+314	+241	+126	+12	-49	-42	-9	+37	+51	+55	+40	+5	-71	-194	-363	
$+50$	-396	-451	-475	-479	-374	-279	-19	+213	+369	+412	+333	+183	-7	-148	-193	-137	-34	+67	+131	+166	+195	+214	+171	+40	-173
$+40$	-257	-446	-505	-426	-318	-218	-5	+199	+319	+330	+233	+51	-163	-313	-224	-61	+82	+167	+231	+164	+379	+370	+237	+2	
$+30$	-157	-336	-402	-312	-181	-2	+151	+216	+212	+109	-67	-271	-424	-476	-307	-110	+56	+161	+242	+343	+447	+438	+308	+87	
$+20$	-99	-238	-275	-197	-77	+435	+112	+142	+116	+85	+121	-249	-486	-439	-319	-114	+16	+126	+218	+325	+406	+404	+287	+97	
$+10$	-59	-133	-271	-211	+79	+56	+95	+85	+20	-30	-119	-236	-317	-160	-277	-142	-10	+76	+142	+217	+223	+232	+197	+64	
$0$	-37	-6	+107	+331	+356	+287	+171	+84	+21	-42	-81	-131	-207	-254	-227	-127	-26	+33	+29	+40	+77	+90	+29	+6	
$-10$	-11	+110	+252	+395	+375	+247	+115	+144	+55	-2	-35	-52	-96	-60	-177	-105	-12	-1	-89	-175	-194	-160	-121	-35	
$-20$	-12	+179	+366	+461	+437	+321	+152	+105	+197	+84	+35	+22	-82	-90	-106	-39	+30	-15	-183	-368	-466	-402	-304	-171	
$-30$	-65	+154	+326	+406	+423	+438	+263	+435	+327	+194	+121	+26	+54	+4	-10	+45	+77	-22	-252	-496	-526	-606	-475	-286	
$-40$	-167	+44	+195	+282	+344	+425	+251	+316	+246	+124	+34	+254	+168	+137	+130	+146	+114	-48	-318	-602	-766	-765	-619	-405	
$-50$	-332	-149	-6	+104	+208	+339	+401	+494	+477	+416	+354	+219	+392	+274	+243	+197	+92	-110	-387	-652	-822	-844	-732	-598	
$-60$	-496	-339	-201	-77	+54	+191	+314	+490	+431	+424	+402	+377	+315	+320	+262	+171	+27	-189	-430	-648	-798	-845	-790	-659	
$-70$	-574	-441	-337	-212	-84	+19	+146	+236	+291	+321	+329	+317	+288	+243	+168	+66	-75	-248	-423	-576	-681	-731	-719	-652	
$-80$	-650	-489	-339	-250	-176	-102	-35	+23	+67	+112	+105	+84	+47	-7	-80	-164	-251	-377	-473	-569	-663	-760	-864	-988	

ORIGINAL PAGE 12  
OF POOR QUALITY

TABLE (49). Secular changes  $\Delta I$  of the total intensity I in units of the 5th decimal between 1780-1842 when the time is increased by one year. For  $\varphi = +90^\circ$ ,  $\Delta J = +0.00065$ ; for  $\varphi = -90^\circ$ ,  $\Delta J = +0.00233$ .

$\varphi$	$\lambda=0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$
$+90^\circ$	+190	+139	+82	+26	-19	-52	-79	-102	-118	-126	-134	-135	-123	-106	-76	-29	+13	+84	+144	+195	+233	+252	+253	+253
$+70$	+222	+126	+27	-20	-129	-177	-203	-214	-227	-240	-255	-269	-281	-291	-294	-215	-171	-6	+144	+248	+317	+382	+436	+464
$+60$	+166	+63	-40	-116	-174	-203	-217	-219	-222	-240	-255	-269	-281	-291	-294	-215	-171	-6	+144	+248	+317	+382	+436	+464
$+50$	+71	-16	-74	-102	-113	-115	-103	-97	-106	-144	-195	-232	-269	-311	-366	-416	-449	-405	-282	-89	+113	+179	+236	+274
$+40$	-32	-92	-79	-34	-32	-26	+21	+81	+55	-8	-84	-132	-173	-228	-289	-369	-450	-489	-361	-140	+25	+139	+239	+274
$+30$	-131	-166	-81	-274	+121	+169	+212	+231	+199	+118	+42	+15	+16	-11	-214	-193	-45	+111	+188	+281	+380	+480	+574	+642
$+20$	-201	-188	-63	+56	+135	+191	+248	+274	+240	+167	+118	+129	+199	+272	+312	-2	-16	+23	+90	+108	+168	+238	+304	+350
$+10$	-207	-126	-3	+48	+77	+127	+204	+250	+225	+172	+147	+180	+274	+323	+358	+377	+374	+16	+16	+10	+16	+16	+16	+16
$0$	-123	+24	+102	+52	+11	+58	+139	+183	+175	+153	+156	+180	+288	+332	+358	+377	+374	+16	+16	+10	+16	+16	+16	+16
$-10$	-32	+131	+134	+11	-32	+10	+111	+160	+155	+153	+174	+219	+288	+342	+395	+423	+423	+167	+215	+314	+419	+528	+642	+754
$-20$	-306	+89	+66	-48	-94	-18	+27	+150	+171	+183	+203	+244	+300	+358	+423	+492	+562	+602	+642	+682	+722	+762	+802	+842
$-30$	-123	-34	-55	-111	-115	-34	+60	+131	+164	+195	+217	+248	+295	+352	+416	+485	+552	+622	+692	+762	+832	+902	+972	+1042
$-40$	-161	-118	-108	-110	-74	-6	+60	+111	+147	+175	+191	+211	+258	+311	+377	+445	+512	+582	+652	+722	+792	+862	+932	+1002
$-50$	-47	-37	-27	-10	+18	+55	+90	+118	+131	+139	+155	+164	+209	+261	+312	+377	+445	+512	+582	+652	+722	+792	+862	+932
$-60$	+191	+167	+167	+156	+160	+153	+145	+145	+145	+145	+145	+145	+145	+145	+145	+145	+145	+145	+145	+145	+145	+145	+145	+145
$-70$	+445	+398	+365	+341	+316	+292	+271	+247	+230	+223	+223	+223	+223	+223	+223	+223	+223	+223	+223	+223	+223	+223	+223	+223
$-80$	+575	+540	+511	+478	+451	+424	+408	+387	+376	+361	+349	+338	+327	+316	+305	+294	+283	+272	+261	+250	+239	+228	+217	+206

TABLE (49). Secular changes  $\Delta I$  of the total intensity I in units of the 5th decimal between 1842-1885 when the time is increased by one year. For  $\varphi = +90^\circ$ ,  $\Delta J = -0.00528$ ; for  $\varphi = -90^\circ$ ,  $\Delta J = +0.00276$ .

$\varphi$	$\lambda=0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$
$+90^\circ$	-336	-332	-323	-323	-332	-332	-346	-360	-373	-385	-394	-404	-416	-432	-434	-433	-413	-377	-383	-369	-348	-350	-346	-346
$+70$	-234	-212	-193	-174	-166	-164	-182	-209	-248	-290	-332	-373	-404	-432	-434	-433	-413	-377	-383	-369	-348	-350	-346	-346
$+60$	-188	-116	-52	-9	+5	+14	+14	-7	-54	-121	-209	-290	-373	-404	-432	-433	-413	-377	-383	-369	-348	-350	-346	-346
$+50$	-205	-63	+58	+137	+170	+182	+182	+154	+100	0	-112	-207	-290	-373	-404	-432	-433	-413	-377	-383	-369	-348	-350	-346
$+40$	-295	-95	+77	+193	+255	+263	+287	+273	+224	+182	-25	-109	-177	-168	-154	-149	-135	-121	-123	-168	-264	-395	-577	-843
$+30$	-393	-164	+245	+166	+228	+292	+316	+318	+260	+199	+5	-55	-128	-107	-86	-65	-61	-57	-58	-137	-280	-460	-674	-946
$+20$	-409	-179	+5	+116	+198	+253	+304	+323	+273	+168	+32	-102	-114	-110	-61	-21	-2	+5	-40	-133	-302	-488	-674	-946
$+10$	-311	-97	+245	+26	+142	+218	+290	+307	+257	+161	+52	-40	-102	-112	-83	-37	-16	-28	-84	-157	-316	-493	-674	-946
$0$	-126	+30	+67	+67	+107	+209	+307	+334	+245	+170	+58	-32	-100	-119	-114	-83	-37	-16	-28	-84	-157	-316	-493	-674
$-10$	+49	+159	+137	+95	+128	+216	+332	+364	+320	+203	+72	-25	-110	-159	-170	-182	-182	-182	-182	-182	-182	-182	-182	-182
$-20$	+135	+237	+188	+123	+133	+190	+276	+304	+273	+184	+63	-56	-159	-237	-273	-287	-287	-287	-287	-287	-287	-287	-287	-287
$-30$	+116	+224	+191	+102	+47	+49	+77	+93	+102	+47	-18	-126	-243	-332	-380	-420	-450	-480	-510	-540	-570	-600	-630	-660
$-40$	-16	+128	+180	-21	-161	-362	-579	-658	-649	-565	-453	-357	-273	-271	-300	-364	-431	-497	-561	-625	-689	-753	-817	-881
$-50$	-182	-75	-114	-257	-436	-579	-658	-649	-565	-453	-357	-273	-271	-300	-364	-431	-497	-561	-625	-689	-753	-817	-881	-945
$-60$	-295	-244	-300	-432	-609	-745	-824	-813	-727	-583	-432	-290	-184	-123	-114	-163	-223	-287	-351	-415	-479	-543	-607	-671
$-70$	-311	-311	-311	-311	-311	-311	-311	-311	-311	-311	-311	-311	-311	-311	-311	-311	-311	-311	-311	-311	-311	-311	-311	-311
$-80$	-241	-248	-278	-325	-364	-393	-400	-371	-332	-273	-203	-120	-54	0	+25	+37	+14	-19	-56	-102	-142	-182	-222	-262

The positive values of the tables above are separated from /53  
the negative values by thick lines which indicate the locations  
on the Earth's surface where the secular motion was zero during this  
period. In order to research the character of the secular changes  
 $\Delta P, \Delta F, \Delta X, \Delta Y, \Delta Z, \Delta \delta, \Delta i, \Delta J$  and  $\Delta J$ , which I will call  $\Delta J$  in short, by  
using the nine tables (41)-(49) for the 17 parallel circles and the  
24 meridians I calculated the numbers m and M of the following tables  
(50), (51), (52) and (53). The quantities m of a parallel circle  
in (50) is the arithmetic mean of the 24 values  $\Delta J$  on a circle,  
formed without consideration of the sines of the individual values  
 $\Delta J$  of the tables above. M in (51) is the arithmetic mean with  
consideration of the sines. Also the m of a meridian of Table (52)  
is the arithmetic mean of the 17 values  $\Delta J$  in them without consid-  
eration of the sine of the individual quantities  $\Delta J$ . M in Table  
(53) is the average with consideration of the sine. m represents  
the quantity of the average yearly secular change. M is the true  
average change. In the following tables (50), (51), (52), (53), for  
brevity, the time is called I between 1550-1600, II between 1600-  
1650, III between 1650-1700, IV between 1700-1780 and V between 1780-  
1842 and VI between 1842-1885.

Regarding Tables (50), (51), (52) and (53), we should note /55  
that we did not consider the values of  $\Delta J$  which apply for the  
poles when they were derived from (41)-(49). In the calculation of  
 $\Delta \delta$  from (46), only the 11 parallel circles  $\phi = +50^\circ, +40^\circ \dots -40^\circ -50^\circ$   
were considered in the calculation. Finally,  $\Delta P, \Delta F, \Delta X, \Delta Y,$   
 $\Delta Z, \Delta T, \Delta J$  are expressed in units of the 5th decimal in the nine  
tables (41)-(49), and in (50), (51), (52), (53) as well.  $\Delta \delta'$  and  
 $\Delta i$  are expressed in minutes.

TABLE (50).  $\eta_L$

$\varphi = +80^\circ$	$+70^\circ$	$+60^\circ$	$+50^\circ$	$+40^\circ$	$+30^\circ$	$+20^\circ$	$+10^\circ$	$0^\circ$	$-10^\circ$	$-20^\circ$	$-30^\circ$	$-40^\circ$	$-50^\circ$	$-60^\circ$	$-70^\circ$	$-80^\circ$	average
$I \Delta \rho = \pm 22$	27	46	71	95	111	126	131	131	123	124	120	115	103	81	53	27	88
$II \Delta \rho = \pm 26$	52	72	97	124	155	183	205	219	231	228	214	205	177	142	101	53	147
$III \Delta \rho = \pm 61$	54	64	87	109	128	140	145	147	150	156	158	159	154	141	117	86	121
$IV \Delta \rho = \pm 21$	33	33	46	74	118	156	167	152	134	100	77	64	57	76	113	151	93
$V \Delta \rho = \pm 135$	114	93	93	107	111	113	107	88	75	83	108	143	179	205	198	182	126
Mittel $\pm 53$	56	62	79	102	125	144	151	147	143	138	137	137	134	129	118	100	115
$I \Delta \rho = \pm 13$	19	26	38	34	39	42	42	41	37	34	36	41	37	28	17	7	31
$II \Delta \rho = \pm 8$	14	21	30	43	59	66	71	66	62	63	61	57	51	42	32	19	45
$III \Delta \rho = \pm 27$	34	33	39	45	49	50	48	45	43	42	46	50	55	57	54	39	44
$IV \Delta \rho = \pm 19$	32	35	25	27	41	59	65	60	47	40	38	31	20	22	49	70	40
$V \Delta \rho = \pm 47$	32	24	29	34	40	45	44	37	36	40	49	57	72	70	50	24	43
Mittel $\pm 23$	26	28	31	37	46	52	54	50	45	44	46	47	47	44	40	32	41
$I \Delta \lambda = \pm 81$	99	111	146	149	123	84	52	59	79	82	59	55	118	162	176	175	107
$II \Delta \lambda = \pm 76$	121	157	192	178	122	79	65	66	82	96	83	76	113	148	158	153	116
$III \Delta \lambda = \pm 145$	139	162	204	219	203	159	151	144	144	149	150	142	187	234	265	295	182
$IV \Delta \lambda = \pm 161$	156	187	192	169	117	94	112	120	121	116	116	131	146	195	274	348	162
$V \Delta \lambda = \pm 111$	85	130	226	282	246	152	141	177	255	260	220	197	198	245	232	140	194
$VI \Delta \lambda = \pm 96$	149	131	178	146	98	97	127	193	273	300	395	379	262	231	181	134	201
Mittel $\pm 112$	125	155	190	190	151	111	108	126	159	167	170	163	171	202	214	207	160
$I \Delta \gamma = \pm 97$	127	157	171	178	181	188	194	194	191	192	211	230	230	216	202	187	185
$II \Delta \gamma = \pm 82$	132	170	191	197	200	205	209	206	202	193	198	198	196	191	174	155	182
$III \Delta \gamma = \pm 144$	153	190	235	281	326	353	365	348	323	308	298	285	285	295	307	306	282
$IV \Delta \gamma = \pm 166$	180	216	246	262	266	262	253	247	234	224	228	243	274	307	341	370	254
$V \Delta \gamma = \pm 116$	114	124	144	161	179	202	213	212	202	189	165	135	94	58	40	48	141
$VI \Delta \gamma = \pm 88$	98	123	147	164	176	183	181	170	161	157	178	208	235	241	206	121	167
Mittel $\pm 116$	134	163	189	207	221	232	236	230	219	210	213	216	219	218	212	198	202
$I \Delta \lambda = \pm 101$	147	170	206	231	249	267	281	275	262	297	342	360	324	244	155	72	234
$II \Delta \lambda = \pm 91$	133	186	218	260	301	325	328	320	288	260	282	310	279	207	128	56	239
$III \Delta \lambda = \pm 62$	113	162	230	322	432	513	543	514	505	507	499	463	408	337	249	146	354
$IV \Delta \lambda = \pm 197$	239	238	288	339	373	383	378	349	380	340	339	393	421	429	395	289	340
$V \Delta \lambda = \pm 127$	216	234	174	203	312	448	495	457	363	296	273	216	136	179	369	516	295
$VI \Delta \lambda = \pm 160$	260	194	225	264	298	335	327	275	261	289	360	423	542	539	400	213	328
Mittel $\pm 156$	185	198	224	269	328	378	397	365	344	331	353	362	352	323	283	215	257

mittel = average



ORIGINAL PAGE IS  
OF POOR QUALITY

/ 54

TABLE (50) continuation m

$\eta = +90^\circ$	$+70^\circ$	$+60^\circ$	$+50^\circ$	$+40^\circ$	$+30^\circ$	$+20^\circ$	$+10^\circ$	$0^\circ$	$-10^\circ$	$-20^\circ$	$-30^\circ$	$-40^\circ$	$-50^\circ$	$-60^\circ$	$-70^\circ$	$-80^\circ$	Min
$I_{ad} =$			$\pm 3.05$	2.47	2.17	2.05	2.01	2.00	2.08	2.19	2.26	2.27	2.28				2.54
$II_{ad} =$			$\pm 3.44$	2.95	2.49	2.25	2.15	2.11	2.15	2.23	2.35	2.42	2.49				2.59
$III_{ad} =$			$\pm 4.66$	3.84	3.09	2.95	2.83	2.67	2.57	2.65	2.82	2.94	3.12				4.03
$IV_{ad} =$			$\pm 5.14$	4.04	3.36	2.94	2.71	2.65	2.60	2.73	2.80	2.70	2.86				3.43
$V_{ad} =$			$\pm 2.18$	2.00	2.06	2.16	2.25	2.38	2.35	2.35	2.24	1.91	1.58				2.14
$VI_{ad} =$			$\pm 2.99$	2.50	2.24	2.04	1.94	1.84	1.97	2.27	2.27	2.40	2.75				2.53
Mean			$\pm 3.63$	2.97	2.71	2.56	2.49	2.43	2.45	2.61	2.87	3.21	3.70				2.88
$I_{ai} = \pm 0.37$	0.68	0.87	1.09	1.34	1.70	2.17	2.61	2.75	2.57	2.04	1.79	1.68	1.57	1.37	1.13	0.92	1.57
$II_{ai} = \pm 0.50$	0.78	1.03	1.35	1.61	2.00	2.44	2.49	3.13	2.86	2.25	1.66	1.32	1.42	1.22	0.97	0.77	1.65
$III_{ai} = \pm 0.78$	0.79	1.05	1.53	2.22	3.10	4.07	4.98	5.27	4.74	3.79	2.96	2.35	1.94	1.64	1.40	1.25	2.58
$IV_{ai} = \pm 1.13$	0.86	1.11	1.50	1.86	2.29	2.79	3.30	3.55	3.35	2.81	2.16	1.88	1.57	1.46	1.58	2.69	2.12
$V_{ai} = \pm 0.53$	0.74	0.90	1.34	2.16	3.13	4.12	4.82	4.88	4.36	3.51	2.58	1.84	1.28	0.96	0.37	0.64	2.24
$VI_{ai} = \pm 0.57$	0.72	0.97	1.21	1.43	1.91	2.46	2.87	2.48	2.65	2.75	2.77	2.88	2.71	2.02	1.48	0.79	1.93
Mean ( $\pm 0.68$ )	0.76	0.99	1.34	1.78	2.35	3.01	3.51	3.68	3.40	2.86	2.34	2.02	1.75	1.44	1.15	1.18	2.02
$I_{at} = \pm 94$	105	124	155	185	228	28	63	69	79	78	54	51	112	155	169	164	108
$II_{at} = \pm 85$	119	147	184	175	118	87	75	80	94	100	86	73	113	143	149	137	116
$III_{at} = \pm 132$	123	157	198	213	197	154	143	139	133	132	128	129	167	195	210	214	163
$IV_{at} = \pm 170$	105	141	163	148	99	78	99	107	107	99	105	121	129	130	175	432	142
$V_{at} = \pm 86$	124	145	236	290	253	156	139	183	250	257	218	193	191	223	160	98	189
$VI_{at} = \pm 127$	146	170	169	138	92	86	119	190	265	286	368	342	257	242	230	122	197
Mean ( $\pm 116$ )	120	147	184	186	148	108	106	122	155	159	160	151	162	182	182	194	152
$I_{at} = \pm 96$	144	166	172	178	162	144	110	79	138	218	272	291	254	187	118	56	165
$II_{at} = \pm 91$	126	154	180	186	196	185	147	93	102	162	224	244	216	160	97	43	134
$III_{at} = \pm 54$	97	134	174	212	238	237	190	145	230	305	347	346	322	274	210	122	214
$IV_{at} = \pm 181$	220	211	229	245	242	205	144	103	141	209	266	329	368	323	340	228	238
$V_{at} = \pm 123$	215	232	214	147	122	130	129	135	160	186	195	163	130	253	402	509	204
$VI_{at} = \pm 373$	281	189	190	209	266	201	183	196	245	312	353	438	516	490	352	183	230
Mean ( $\pm 153$ )	181	186	194	196	195	184	151	125	169	232	276	302	301	291	253	191	211

TABLE (51).  $M$ .

$\varphi = +20^\circ +70^\circ +60^\circ +50^\circ +40^\circ +30^\circ +20^\circ +10^\circ 0^\circ -10^\circ -20^\circ -30^\circ -40^\circ -50^\circ -60^\circ -70^\circ -80^\circ$	Mittel
$II_{\Delta T} = +22$	+18 +6 +8 +4 +4 +4 0 -2 -4 -8 -8 -4 -2 0 +2 +6 +2
$III_{\Delta T} = 0$	+4 +8 +8 +6 0 -4 -2 -6 -6 -4 -4 -2 0 +4 +12 +20 +2
$IV_{\Delta T} = -61$	-51 -37 -31 -24 -21 -17 -10 +1 +10 +12 +16 +16 +31 +47 +69 +84 +2
$V_{\Delta T} = +3$	-3 -5 +7 +24 +37 +45 +32 +16 0 0 -5 -11 -39 -76 -119 -151 -14
$VI_{\Delta T} = -135$	-114 -88 -68 -61 -49 -56 -58 -60 -44 -9 +53 +121 +179 +208 +198 +182 +12
Mittel	-14 -29 -23 -15 -10 -6 -6 -8 -10 -9 -2 -10 -13 -12 -7 0 0
$II_{\Delta F} = -10$	-7 -2 0 -1 -1 0 0 +1 +2 +3 +2 +2 +1 0 -3 -5 -1
$III_{\Delta F} = +4$	+1 -2 -5 -3 +2 -1 +2 +1 +1 +1 +2 +3 +2 -3 -8 -13 -1
$IV_{\Delta F} = +24$	+15 +7 +4 +4 +6 +6 +2 -2 -5 -4 0 +1 -2 -12 -24 -35 -1
$V_{\Delta F} = -4$	+7 +13 +8 -5 -18 -21 -13 0 +5 +2 -6 -8 +1 +12 +49 +70 +6
$VI_{\Delta F} = +57$	+32 +17 +6 +2 +4 +9 +18 +28 +31 +19 -8 -44 -69 -69 -48 -19 -3
Mittel	+12 +60 +7 +3 -7 -1 -1 +2 +6 +7 +4 -2 -9 -13 -12 -7 0 0
$II_{\Delta X} = +20$	+26 +26 +16 +10 +8 +10 +14 +12 +8 +6 +2 -4 -12 -18 -14 -4 +5
$III_{\Delta X} = +21$	+34 +28 +20 +14 +9 +12 +16 +12 +8 +4 +4 -6 -12 -20 -22 -13 +6
$IV_{\Delta X} = -18$	-24 -15 -2 +12 +21 +15 +4 0 +4 +2 +2 -8 -29 -44 -49 -31 -9
$V_{\Delta X} = -51$	-74 -65 -34 -16 -23 -41 -87 -58 -35 -11 -13 -41 -82 -115 -111 -67 -53
$VI_{\Delta X} = +45$	+35 -23 -95 -112 -56 +31 +93 +56 +52 +11 +17 +89 +132 +255 +232 +140 +52
$II_{\Delta X} = -91$	-135 -132 -89 -39 -5 +23 +19 -35 -148 -293 -335 -379 -241 -44 +97 +105 -105
Mittel	-12 -23 -30 -31 -22 -8 +8 +15 +5 -18 -47 -64 -58 -32 +1 +21 +20 -16

/ 55

 $M = \Delta y$  = to zero for each parallel circle

mittel = average

TABLE (51) continuation  $M$ .

$\varphi = +20^\circ +70^\circ +60^\circ +50^\circ +40^\circ +30^\circ +20^\circ +10^\circ 0^\circ -10^\circ -20^\circ -30^\circ -40^\circ -50^\circ -60^\circ -70^\circ -80^\circ$	Mittel
$II_{\Delta Z} = +62$	+38 +7 +6 +2 +2 +6 -2 -6 -10 -14 -12 -14 -12 -2 +14 +30 +6
$III_{\Delta Z} = +76$	+50 +20 +8 +6 +6 +4 0 -10 -16 -20 -18 -18 -12 0 +18 +36 +8
$IV_{\Delta Z} = -26$	-2 +18 +32 +20 +4 -8 -12 -10 -8 -8 -16 -20 -12 +14 +54 +90 +6
$V_{\Delta Z} = -180$	-124 -64 -39 -36 -50 -42 -21 +19 +34 +30 +10 -1 +29 +99 +189 +262 +6
$VI_{\Delta Z} = +26$	-43 -85 -48 +44 +134 +155 +35 +11 -31 -13 +34 +47 -26 -179 -369 -516 -45
$II_{\Delta Z} = -360$	-260 -154 -74 -42 -50 -86 -142 -204 -216 -128 +77 +335 +520 +539 +400 +211 +22
Mittel	-67 -57 -58 -19 0 +8 +4 -14 -33 -41 -25 +12 +55 +81 +78 +31 +19 0
$II_{\Delta \delta} =$	+0,06 +0,11 +0,13 +0,13 +0,13 +0,10 +0,07 +0,01 -0,03 -0,01 +0,02
$III_{\Delta \delta} =$	+0,41 +0,36 +0,30 +0,27 +0,21 +0,17 +0,12 +0,05 0,00 +0,01 +0,08
$IV_{\Delta \delta} =$	+0,72 +0,13 +0,39 +0,26 +0,15 +0,13 +0,13 +0,21 +0,30 +0,36 +0,35
$V_{\Delta \delta} =$	+1,30 +0,76 +0,41 +0,21 +0,10 +0,03 +0,03 +0,10 +0,28 +0,55 +0,78
$VI_{\Delta \delta} =$	-0,28 -0,57 -0,35 -0,18 -0,02 +0,14 +0,32 +0,52 +0,65 +0,58 +0,38
$II_{\Delta \delta} =$	-0,59 -0,26 -0,06 +0,05 +0,10 +0,07 +0,04 +0,09 +0,24 +0,79 +0,57
Mittel	+0,17 +0,03 +0,15 +0,12 +0,11 +0,11 +0,12 +0,15 +0,24 +0,38 +0,57
$II_{\Delta i} = +0,48$	+0,24 +0,22 +0,18 +0,10 +0,05 -0,01 +0,06 +0,07 +0,05 -0,01 -0,09 -0,16 -0,16 -0,12 -0,08 +0,06
$III_{\Delta i} = +0,15$	+0,01 +0,05 +0,03 0,00 -0,08 -0,15 -0,16 -0,14 -0,11 -0,07 0,00 -0,03 -0,02 -0,03 +0,03 +0,01
$IV_{\Delta i} = -0,78$	-0,28 -0,21 -0,12 -0,11 -0,12 -0,11 -0,07 +0,03 +0,16 +0,19 +0,14 +0,10 +0,07 +0,13 +0,26 +0,29
$V_{\Delta i} = -0,59$	-0,17 -0,04 -0,15 -0,34 -0,51 -0,52 -0,31 +0,17 +0,59 +0,73 +0,58 +0,38 +0,37 +0,57 +1,16 +2,69 +0,27
$VI_{\Delta i} = -0,25$	-0,39 -0,23 +0,18 +0,62 +0,96 +1,00 +0,61 +0,04 -0,20 +0,04 +0,51 +0,99 +1,16 +0,96 +0,33 -0,66 +0,33
$II_{\Delta i} = +0,54$	+0,58 +0,56 +0,37 +0,16 -0,06 -0,47 -1,03 -1,23 -1,39 -1,78 -1,03 -0,50 +0,57 +1,08 +1,15 +0,77 -0,13
Mittel	0,08 0,00 +0,06 +0,10 +0,08 +0,05 -0,03 -0,16 -0,19 -0,25 -0,14 +0,02 +0,19 +0,33 +0,42 +0,47 +0,65 +0,03
$II_{\Delta T} = -76$	-26 -14 -13 -8 0 +6 +13 +13 +11 +10 +5 -2 -12 -20 -21 -17 -9
$III_{\Delta T} = -19$	+11 +9 +6 +5 +2 +8 +10 +7 +4 +3 +6 -1 -3 -8 -3 +34 +4
$IV_{\Delta T} = +132$	+41 +27 +19 +21 +21 +11 +1 -1 +6 +7 +11 +9 -2 0 +24 +157 +28
$V_{\Delta T} = +76$	+1 -13 +2 +11 -1 -24 -42 -40 -17 +10 +15 0 -15 -1 +108 +432 +30
$VI_{\Delta T} = +49$	+56 -1 -75 -98 -50 +31 +92 +54 +50 +13 +21 +93 +180 +223 +160 -14 +48
$II_{\Delta T} = -127$	-137 -121 -87 -40 -8 +17 +12 -39 -146 -279 -368 -342 -204 -19 +102 +100 -100
Mittel	+6 -9 -20 -25 -18 -6 +8 +14 +6 -15 -39 -52 -40 -9 +29 +62 +115 0
$II_{\Delta \omega} = +56$	+29 +9 -1 +1 +11 +24 +28 +27 +24 +25 +18 +11 +5 -7 -23 -34 +12
$III_{\Delta \omega} = +74$	+50 +22 +16 +20 +24 +24 +17 +6 +6 +14 +20 +18 +12 0 -16 -30 +16
$IV_{\Delta \omega} = -15$	+10 +23 +40 +30 +21 +13 +16 +27 +37 +32 +34 +30 +18 -9 -40 -71 +12
$V_{\Delta \omega} = -170$	-120 -58 -20 -3 -10 -13 -5 +3 +18 +29 +30 +21 -14 -73 -137 -184 -41
$VI_{\Delta \omega} = +31$	-32 -83 -81 -31 +41 +82 +87 +75 +55 +28 +8 +30 +116 +253 +402 +509 +88
$II_{\Delta \omega} = -373$	-281 -186 -108 -69 -61 -62 -59 -59 -71 -136 -266 -419 -516 -490 -350 -183 -217
Mittel	-66 -57 -44 -26 -9 +4 +11 +14 +14 +11 -1 -26 -51 -63 -54 -27 +1 -22

mittel = average

ORIGINAL PAGE 19  
OF POOR QUALITY

TABLE (52) 11.

$\lambda, 0^\circ$	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°	195°	210°	225°	240°	255°	270°	285°	300°	315°	330°	345°	Mittel	
$\mu_{\text{H}} \pm 50$	32	100	159	178	174	148	96	64	42	20	59	41	35	37	33	25	58	75	85	109	148	178	167	116	88
$\mu_{\text{H}} \pm 30$	110	207	256	233	174	124	124	107	104	92	80	80	79	61	46	63	126	182	232	293	396	447	347	95	197
$\mu_{\text{H}} \pm 10$	131	174	183	155	113	73	67	60	54	47	50	50	46	30	17	32	61	115	176	238	251	234	189	128	71
$\mu_{\text{H}} \pm 179$	159	161	93	43	61	75	85	88	83	79	81	85	88	82	70	66	66	76	96	108	102	75	57	112	93
$\mu_{\text{H}} \pm 108$	116	108	64	63	86	95	98	93	87	77	72	72	69	64	54	44	34	24	14	10	197	200	197	126	
$\mu_{\text{H}} \pm 108$	116	108	64	63	86	95	98	93	87	77	72	72	69	64	54	44	34	24	14	10	197	200	197	126	
$\mu_{\text{H}} \pm 17$	12	36	60	67	46	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	31
$\mu_{\text{H}} \pm 38$	58	73	70	49	33	41	39	29	25	34	39	34	33	21	18	27	42	66	87	88	67	44	31	44	45
$\mu_{\text{H}} \pm 70$	52	21	25	31	31	33	34	31	28	30	38	45	45	39	31	38	39	44	53	53	50	36	46	40	40
$\mu_{\text{H}} \pm 60$	46	30	25	34	43	48	50	45	37	27	17	26	33	33	30	29	36	40	61	70	72	68	65	43	43
$\mu_{\text{H}} \pm 41$	45	53	53	42	35	34	37	36	34	27	23	28	34	30	23	24	31	45	57	68	67	56	47	47	47
$\mu_{\text{H}} \pm 97$	47	73	145	184	175	163	149	148	139	103	54	29	70	35	25	25	62	61	70	101	143	155	134	107	107
$\mu_{\text{H}} \pm 66$	63	119	181	200	177	154	123	108	108	69	59	59	106	108	78	76	102	100	109	139	157	147	103	116	116
$\mu_{\text{H}} \pm 74$	139	268	323	288	201	180	205	205	193	142	75	116	138	121	101	108	156	227	266	298	249	172	95	182	182
$\mu_{\text{H}} \pm 146$	149	183	203	170	141	170	188	177	151	145	157	178	172	137	85	67	95	146	206	237	223	195	162	162	162
$\mu_{\text{H}} \pm 306$	313	235	121	102	153	184	201	204	195	182	187	203	220	208	185	166	180	160	177	187	181	185	242	194	194
$\mu_{\text{H}} \pm 234$	235	168	160	185	216	247	256	233	191	139	105	107	115	139	138	161	206	255	281	282	271	265	261	261	261
$\mu_{\text{H}} \pm 154$	153	174	190	188	177	187	180	165	143	107	108	116	137	133	112	109	128	152	189	207	207	188	162	160	160
$\mu_{\text{H}} \pm 310$	318	412	314	151	149	205	176	143	107	108	116	137	133	112	109	128	152	189	207	207	207	188	162	160	160
$\mu_{\text{H}} \pm 384$	396	360	218	51	247	256	138	103	43	105	138	156	59	141	179	143	92	52	231	282	180	61	155	182	182
$\mu_{\text{H}} \pm 416$	567	424	159	299	331	191	52	61	134	187	243	352	352	352	366	342	328	270	305	205	59	168	324	182	182
$\mu_{\text{H}} \pm 483$	609	260	206	307	322	250	141	94	133	173	158	119	179	254	270	302	336	341	239	96	335	406	446	280	280
$\mu_{\text{H}} \pm 257$	257	269	317	230	189	74	41	19	49	49	49	61	64	82	104	138	161	127	77	70	187	335	390	141	141
$\mu_{\text{H}} \pm 215$	215	268	257	181	96	40	37	28	137	161	158	115	55	79	131	171	176	156	122	211	327	327	257	207	207
$\mu_{\text{H}} \pm 362$	362	332	345	203	211	165	97	88	103	145	154	133	134	163	190	194	193	185	171	169	169	272	345	207	207
$\mu_{\text{H}} \pm 463$	463	441	372	494	440	302	210	252	251	201	160	130	104	155	133	124	108	137	109	159	390	475	391	235	235
$\mu_{\text{H}} \pm 133$	133	181	275	461	508	362	188	161	175	238	191	102	64	168	186	186	179	186	190	324	479	479	317	234	234
$\mu_{\text{H}} \pm 129$	129	167	563	694	546	293	296	292	304	292	223	176	234	240	172	139	329	360	538	623	699	598	362	239	239
$\mu_{\text{H}} \pm 389$	389	548	530	387	302	231	286	270	192	181	236	231	250	186	102	86	193	389	582	677	695	550	379	338	338
$\mu_{\text{H}} \pm 518$	518	566	407	166	168	222	210	250	256	230	209	227	281	320	323	277	228	232	232	232	381	353	208	192	192
$\mu_{\text{H}} \pm 468$	468	326	184	248	313	349	358	332	332	270	126	141	208	243	246	234	227	227	227	393	536	547	527	328	328
$\mu_{\text{H}} \pm 162$	162	302	360	401	332	364	359	263	264	245	200	177	201	231	246	234	227	227	227	393	536	547	527	328	328
$\mu_{\text{H}} \pm 470$	470	607	666	479	141	247	187	187	187	239	205	205	201	161	131	164	177	226	321	462	462	462	361	254	254
$\mu_{\text{H}} \pm 533$	533	619	521	325	354	383	383	167	167	167	167	167	167	167	167	167	167	167	167	167	167	167	167	167	167
$\mu_{\text{H}} \pm 239$	239	412	446	300	459	515	309	097	074	160	249	302	234	322	408	450	455	455	455	455	455	455	455	455	455
$\mu_{\text{H}} \pm 266$	266	427	362	363	382	274	138	132	206	213	184	135	190	272	350	431	431	431	431	431	431	431	431	431	431
$\mu_{\text{H}} \pm 394$	394	398	518	401	225	125	061	035	081	075	065	073	061	066	104	164	158	137	137	137	137	137	137	137	137
$\mu_{\text{H}} \pm 518$	518	411	396	317	179	099	096	092	126	144	175	191	194	075	109	185	242	270	270	270	270	270	270	270	270
$\mu_{\text{H}} \pm 518$	518	411	396	317	179	099	096	092	126	144	175	191	194	075	109	185	242	270	270	270	270	270	270	270	270
$\mu_{\text{H}} \pm 518$	518	411	396	317	179	099	096	092	126	144	175	191	194	075	109	185	242	270	270	270	270	270	270	270	270
$\mu_{\text{H}} \pm 518$	518	411	396	317	179	099	096	092	126	144	175	191	194	075	109	185	242	270	270	270	270	270	270	270	270
$\mu_{\text{H}} \pm 518$	518	411	396	317	179	099	096	092	126	144	175	191	194	075	109	185	242	270	270	270	270	270	270	270	270
$\mu_{\text{H}} \pm 518$	518	411	396	317	179	099	096	092	126	144	175	191	194	075	109	185	242	270	270	270	270	270	270	270	270
$\mu_{\text{H}} \pm 518$	518	411	396	317	179	099	096	092	126	144	175	191	194	075	109	185	242	270	270	270	270	270	270	270	270
$\mu_{\text{H}} \pm 518$	518	411	396	317	179	099	096	092	126	144	175	191	194	075	109	185	242	270	270	270	270	270	270	270	270
$\mu_{\text{H}} \pm 518$	518	411	396	317	179	099	096	092	126	144	175	191	194	075	109	185	242	270	270	270	270	270	270	270	270
$\mu_{\text{H}} \pm 518$	518	411	396	317	179	099	096	092	126	144	175	191	194	075	109	185	242	270	270	270	270	270	270	270	270
$\mu_{\text{H}} \pm 518$	518	411	396	317	179	099	096	092	126	144	175	191	194	075	109	185	242	270	270	270	270	270	270	270	270
$\mu_{\text{H}} \pm 518$	518	411	396	317	179	099	096	092	126	144	175	191	194	075	109	185	242	270	270	270	270	270	270	270	270
$\mu_{\text{H}} \pm 518$	518	411	396	317	179	099	096	092	126	144	175	191	194	075	109	185	242	270	270	270	270	270	270	270	270
$\mu_{\text{H}} \pm 518$	518	411	396	317	179	099	096	092	126	144	175	191	194	075	109	185	242	270	270	270	270	270	270	270	270
$\mu_{\text{H}} \pm 518$	518	411	396	317	179	099	096	092	126	144	175	191	194	075	109	185	242	270	270	270	270	270	270	270	270
$\mu_{\text{H}} \pm 518$	518	411	396	317	179	099	096	092	126	144	175	191	194	075	109	185	242	270	270	270	270	270	270	270	270
$\mu_{\text{H}} \pm 518$	518	411	396	317	179	099	096	092	126	144	175	191	194	075	109	185	242	270	270	270	270				

TABLE (52) con'd, m.

$\lambda = 0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$	$360^\circ$
$T_{\text{air}} = \pm 0.01$	1.20	1.02	0.86	0.71	0.57	0.44	0.33	0.24	0.17	0.12	0.08	0.05	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
$T_{\text{air}} = \pm 0.02$	2.34	2.00	1.68	1.39	1.14	0.91	0.70	0.52	0.37	0.25	0.17	0.11	0.07	0.04	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
$T_{\text{air}} = \pm 0.03$	3.51	2.98	2.48	2.01	1.57	1.16	0.87	0.61	0.40	0.26	0.17	0.11	0.07	0.04	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
$T_{\text{air}} = \pm 0.05$	5.11	4.31	3.54	2.84	2.21	1.63	1.10	0.75	0.48	0.30	0.19	0.12	0.08	0.05	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
$T_{\text{air}} = \pm 0.07$	6.71	5.61	4.54	3.64	2.84	2.11	1.50	0.99	0.61	0.37	0.22	0.14	0.09	0.06	0.04	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
$T_{\text{air}} = \pm 0.10$	8.31	6.91	5.54	4.34	3.34	2.41	1.70	1.10	0.65	0.39	0.23	0.14	0.09	0.06	0.04	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
$T_{\text{air}} = \pm 0.15$	11.91	10.01	8.11	6.41	4.91	3.51	2.41	1.61	1.01	0.59	0.35	0.21	0.13	0.08	0.05	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
$T_{\text{air}} = \pm 0.20$	15.51	13.21	10.71	8.51	6.51	4.71	3.11	2.01	1.21	0.71	0.41	0.25	0.15	0.09	0.06	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
$T_{\text{air}} = \pm 0.25$	19.11	16.41	13.51	10.81	8.31	5.91	3.91	2.51	1.51	0.81	0.47	0.28	0.17	0.10	0.06	0.04	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
$T_{\text{air}} = \pm 0.30$	22.71	19.61	16.31	13.11	10.11	7.41	4.71	2.91	1.71	0.91	0.51	0.30	0.18	0.11	0.07	0.04	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
$T_{\text{air}} = \pm 0.35$	26.31	22.81	19.11	15.41	12.11	9.01	5.61	3.31	1.91	1.01	0.57	0.33	0.20	0.12	0.07	0.04	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
$T_{\text{air}} = \pm 0.40$	29.91	26.01	21.91	17.81	14.11	10.41	6.71	3.91	2.21	1.11	0.63	0.37	0.22	0.13	0.08	0.05	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01
$T_{\text{air}} = \pm 0.45$	33.51	29.21	24.61	20.11	15.91	11.61	7.51	4.31	2.51	1.21	0.69	0.41	0.25	0.15	0.09	0.06	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01
$T_{\text{air}} = \pm 0.50$	37.11	32.41	27.41	22.41	17.61	12.81	8.11	4.71	2.71	1.31	0.75	0.43	0.27	0.16	0.10	0.06	0.04	0.02	0.01	0.01	0.01	0.01	0.01	0.01
$T_{\text{air}} = \pm 0.55$	40.71	35.61	30.11	24.91	19.41	14.11	9.11	5.11	2.91	1.41	0.81	0.47	0.28	0.17	0.10	0.06	0.04	0.02	0.01	0.01	0.01	0.01	0.01	0.01
$T_{\text{air}} = \pm 0.60$	44.31	38.61	32.61	26.91	21.41	15.61	10.11	5.61	3.11	1.51	0.87	0.51	0.30	0.18	0.11	0.07	0.04	0.02	0.01	0.01	0.01	0.01	0.01	0.01
$T_{\text{air}} = \pm 0.65$	47.91	41.61	35.11	28.91	23.41	17.11	11.11	6.11	3.31	1.61	0.91	0.53	0.31	0.19	0.11	0.07	0.04	0.02	0.01	0.01	0.01	0.01	0.01	0.01
$T_{\text{air}} = \pm 0.70$	51.51	44.61	37.61	30.91	25.41	18.61	12.11	6.61	3.51	1.71	0.97	0.57	0.33	0.20	0.12	0.08	0.05	0.03	0.02	0.01	0.01	0.01	0.01	0.01
$T_{\text{air}} = \pm 0.75$	55.11	47.61	39.61	32.91	27.41	20.11	13.11	7.11	3.71	1.81	1.01	0.61	0.35	0.21	0.13	0.08	0.05	0.03	0.02	0.01	0.01	0.01	0.01	0.01
$T_{\text{air}} = \pm 0.80$	58.71	50.61	41.61	34.91	29.41	21.61	14.11	7.61	3.91	1.91	1.11	0.65	0.37	0.22	0.14	0.09	0.06	0.03	0.02	0.01	0.01	0.01	0.01	0.01
$T_{\text{air}} = \pm 0.85$	62.31	53.61	43.61	36.91	31.41	23.11	15.11	8.11	4.11	2.01	1.21	0.69	0.39	0.23	0.15	0.09	0.06	0.03	0.02	0.01	0.01	0.01	0.01	0.01
$T_{\text{air}} = \pm 0.90$	65.91	56.61	45.61	38.91	33.41	24.61	16.11	8.61	4.31	2.11	1.31	0.73	0.41	0.25	0.16	0.10	0.06	0.04	0.02	0.01	0.01	0.01	0.01	0.01
$T_{\text{air}} = \pm 0.95$	69.51	59.61	47.61	40.91	35.41	26.11	17.11	9.11	4.51	2.21	1.41	0.77	0.43	0.27	0.17	0.10	0.06	0.04	0.02	0.01	0.01	0.01	0.01	0.01
$T_{\text{air}} = \pm 1.00$	73.11	62.61	49.61	42.91	37.41	27.61	18.11	9.61	4.71	2.31	1.51	0.81	0.45	0.28	0.18	0.11	0.07	0.04	0.02	0.01	0.01	0.01	0.01	0.01
$T_{\text{air}} = \pm 1.05$	76.71	65.61	51.61	44.91	39.41	29.11	19.11	10.11	4.91	2.41	1.61	0.85	0.47	0.29	0.19	0.12	0.07	0.04	0.02	0.01	0.01	0.01	0.01	0.01
$T_{\text{air}} = \pm 1.10$	80.31	68.61	53.61	46.91	41.41	30.61	20.11	10.61	5.11	2.51	1.71	0.89	0.49	0.30	0.20	0.13	0.08	0.05	0.03	0.02	0.01	0.01	0.01	0.01
$T_{\text{air}} = \pm 1.15$	83.91	71.61	55.61	48.91	43.41	32.11	21.11	11.11	5.31	2.61	1.81	0.93	0.51	0.31	0.21	0.14	0.09	0.06	0.03	0.02	0.01	0.01	0.01	0.01
$T_{\text{air}} = \pm 1.20$	87.51	74.61	57.61	50.91	45.41	33.61	22.11	11.61	5.51	2.71	1.91	0.97	0.53	0.32	0.22	0.15	0.09	0.06	0.03	0.02	0.01	0.01	0.01	0.01
$T_{\text{air}} = \pm 1.25$	91.11	77.61	59.61	52.91	47.41	35.11	23.11	12.11	5.71	2.81	2.01	1.01	0.55	0.33	0.23	0.16	0.10	0.06	0.04	0.02	0.01	0.01	0.01	0.01
$T_{\text{air}} = \pm 1.30$	94.71	80.61	61.61	54.91	49.41	36.61	24.11	12.61	5.91	2.91	2.11	1.05	0.57	0.34	0.24	0.17	0.11	0.07	0.04	0.02	0.01	0.01	0.01	0.01
$T_{\text{air}} = \pm 1.35$	98.31	83.61	63.61	56.91	51.41	38.11	25.11	13.11	6.11	3.01	2.21	1.09	0.59	0.35	0.25	0.18	0.12	0.08	0.05	0.03	0.02	0.01	0.01	0.01
$T_{\text{air}} = \pm 1.40$	101.91	86.61	65.61	58.91	53.41	39.61	26.11	13.61	6.31	3.11	2.31	1.13	0.61	0.36	0.26	0.19	0.13	0.09	0.06	0.03	0.02	0.01	0.01	0.01
$T_{\text{air}} = \pm 1.45$	105.51	89.61	67.61	60.91	55.41	41.11	27.11	14.11	6.51	3.21	2.41	1.17	0.63	0.37	0.27	0.20	0.14	0.10	0.07	0.04	0.02	0.01	0.01	0.01
$T_{\text{air}} = \pm 1.50$	109.11	92.61	69.61	62.91	57.41	42.61	28.11	14.61	6.71	3.31	2.51	1.21	0.65	0.38	0.28	0.21	0.15	0.11	0.08	0.05	0.03	0.02	0.01	0.01
$T_{\text{air}} = \pm 1.55$	112.71	95.61	71.61	64.91	59.41	44.11	29.11	15.11	6.91	3.41	2.61	1.25	0.67	0.39	0.29	0.22	0.16	0.12	0.09	0.06	0.03	0.02	0.01	0.01
$T_{\text{air}} = \pm 1.60$	116.31	98.61	73.61	66.91	61.41	45.61	30.11	15.61	7.11	3.51	2.71	1.29	0.69	0.40	0.30	0.23	0.17	0.13	0.10	0.07	0.04	0.02	0.01	0.01
$T_{\text{air}} = \pm 1.65$	119.91	101.61	75.61	68.91	63.41	47.11	31.11	16.11	7.31	3.61	2.81	1.33	0.71	0.41	0.31	0.24	0.18	0.14	0.11	0.08	0.05	0.03	0.02	0.01
$T_{\text{air}} = \pm 1.70$	123.51	104.61	77.61	70.91	65.41	48.61	32.11	16.61	7.51	3.71	2.91	1.37	0.73	0.42	0.32	0.25	0.19	0.15	0.12	0.09	0.06	0.03	0.02	0.01
$T_{\text{air}} = \pm 1.75$	127.11	107.61	79.61	72.91	67.41	50.11	33.11	17.11	7.71	3.81	3.01	1.41	0.75	0.43	0.33	0.26	0.20	0.16	0.13	0.10	0.07	0.04	0.02	0.01
$T_{\text{air}} = \pm 1.80$	130.71	110.61	81.61	74.91	69.41	51.61	34.11	17.61	7.91	3.91	3.11	1.45	0.77	0.44	0.34	0.27	0.21	0.17	0.14	0.11	0.08	0.05	0.03	0.02
$T_{\text{air}} = \pm 1.85$	134.31	113.61	83.61	76.91	71.41	53.11	35.11	18.11	8.11	4.01	3.21	1.49	0.79	0.45	0.35	0.28	0.22	0.18	0.15	0.12	0.09	0.06	0.03	0.02
$T_{\text{air}} = \pm 1.90$	137.91	116.61	85.61	78.91	73.41	54.61	36.11	18.61	8.31	4.11	3.31	1.53	0.81	0.46	0.36	0.29	0.23	0.19	0.16	0.13	0.10	0.07	0.04	0.02
$T_{\text{air}} = \pm 1.95$	141.51	119.61	87.61	80.91	75.41	56.11	37.11	19.11	8.51	4.21	3.41	1.57	0.83	0.47	0.37	0.30	0.24	0.20	0.17	0.14	0.11	0.08	0.05	0.03
$T_{\text{air}} = \pm 2.00$	145.11	122.61	89.61	82.91	77.41	57.61	38.11	19.61	8.71	4.31	3.51	1.61	0.85	0.48	0.38	0.31	0.25	0.21	0.18	0.15	0.12	0.09	0.06	0.03
$T_{\text{air}} = \pm 2.05$	148.71	125.61	91.61	84.91	79.41	59.11	39.11	20.11	8.91	4.41	3.61	1.65	0.87	0.49	0.39	0.32	0.26	0.22	0.19	0.16	0.13	0.10	0.07	0.04
$T_{\text{air}} = \pm 2.10$	152.31	128.61	93.61	86.91	81.41	60.61	40.11	20.61	9.11	4.51	3.71	1.69	0.89	0.50	0.40	0.33	0.27	0.23	0.20	0.17	0.14	0.11	0.08	0.05
$T_{\text{air}} = \pm 2.15$	155.91	131.61	95.61	88.91	83.41	62.11	41.11	21.11	9.31	4.61	3.81	1.73	0.91	0.51	0.41	0.34	0.28	0.24	0.21	0.18	0.15	0.12	0.09	0.06
$T_{\text{air}} = \pm 2.20$	159.51	134.61	97.61	90.91</																				



TABLE (51) M.

$\lambda = 0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$	$195^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$255^\circ$	$270^\circ$	$285^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$345^\circ$	$360^\circ$
$T_{0,0} = +3.07$	+3.16	+3.25	+3.34	+3.43	+3.52	+3.61	+3.70	+3.79	+3.88	+3.97	+4.06	+4.15	+4.24	+4.33	+4.42	+4.51	+4.60	+4.69	+4.78	+4.87	+4.96	+5.05	+5.14	+5.23
$T_{0,1} = +3.18$	+3.27	+3.36	+3.45	+3.54	+3.63	+3.72	+3.81	+3.90	+3.99	+4.08	+4.17	+4.26	+4.35	+4.44	+4.53	+4.62	+4.71	+4.80	+4.89	+4.98	+5.07	+5.16	+5.25	+5.34
$T_{0,2} = +3.29$	+3.38	+3.47	+3.56	+3.65	+3.74	+3.83	+3.92	+4.01	+4.10	+4.19	+4.28	+4.37	+4.46	+4.55	+4.64	+4.73	+4.82	+4.91	+5.00	+5.09	+5.18	+5.27	+5.36	+5.45
$T_{0,3} = +3.40$	+3.49	+3.58	+3.67	+3.76	+3.85	+3.94	+4.03	+4.12	+4.21	+4.30	+4.39	+4.48	+4.57	+4.66	+4.75	+4.84	+4.93	+5.02	+5.11	+5.20	+5.29	+5.38	+5.47	+5.56
$T_{0,4} = +3.51$	+3.60	+3.69	+3.78	+3.87	+3.96	+4.05	+4.14	+4.23	+4.32	+4.41	+4.50	+4.59	+4.68	+4.77	+4.86	+4.95	+5.04	+5.13	+5.22	+5.31	+5.40	+5.49	+5.58	+5.67
$T_{0,5} = +3.62$	+3.71	+3.80	+3.89	+3.98	+4.07	+4.16	+4.25	+4.34	+4.43	+4.52	+4.61	+4.70	+4.79	+4.88	+4.97	+5.06	+5.15	+5.24	+5.33	+5.42	+5.51	+5.60	+5.69	+5.78
$T_{0,6} = +3.73$	+3.82	+3.91	+4.00	+4.09	+4.18	+4.27	+4.36	+4.45	+4.54	+4.63	+4.72	+4.81	+4.90	+4.99	+5.08	+5.17	+5.26	+5.35	+5.44	+5.53	+5.62	+5.71	+5.80	+5.89
$T_{0,7} = +3.84$	+3.93	+4.02	+4.11	+4.20	+4.29	+4.38	+4.47	+4.56	+4.65	+4.74	+4.83	+4.92	+5.01	+5.10	+5.19	+5.28	+5.37	+5.46	+5.55	+5.64	+5.73	+5.82	+5.91	+6.00
$T_{0,8} = +3.95$	+4.04	+4.13	+4.22	+4.31	+4.40	+4.49	+4.58	+4.67	+4.76	+4.85	+4.94	+5.03	+5.12	+5.21	+5.30	+5.39	+5.48	+5.57	+5.66	+5.75	+5.84	+5.93	+6.02	+6.11
$T_{0,9} = +4.06$	+4.15	+4.24	+4.33	+4.42	+4.51	+4.60	+4.69	+4.78	+4.87	+4.96	+5.05	+5.14	+5.23	+5.32	+5.41	+5.50	+5.59	+5.68	+5.77	+5.86	+5.95	+6.04	+6.13	+6.22
$T_{0,10} = +4.17$	+4.26	+4.35	+4.44	+4.53	+4.62	+4.71	+4.80	+4.89	+4.98	+5.07	+5.16	+5.25	+5.34	+5.43	+5.52	+5.61	+5.70	+5.79	+5.88	+5.97	+6.06	+6.15	+6.24	+6.33
$T_{0,11} = +4.28$	+4.37	+4.46	+4.55	+4.64	+4.73	+4.82	+4.91	+5.00	+5.09	+5.18	+5.27	+5.36	+5.45	+5.54	+5.63	+5.72	+5.81	+5.90	+5.99	+6.08	+6.17	+6.26	+6.35	+6.44
$T_{0,12} = +4.39$	+4.48	+4.57	+4.66	+4.75	+4.84	+4.93	+5.02	+5.11	+5.20	+5.29	+5.38	+5.47	+5.56	+5.65	+5.74	+5.83	+5.92	+6.01	+6.10	+6.19	+6.28	+6.37	+6.46	+6.55
$T_{0,13} = +4.50$	+4.59	+4.68	+4.77	+4.86	+4.95	+5.04	+5.13	+5.22	+5.31	+5.40	+5.49	+5.58	+5.67	+5.76	+5.85	+5.94	+6.03	+6.12	+6.21	+6.30	+6.39	+6.48	+6.57	+6.66
$T_{0,14} = +4.61$	+4.70	+4.79	+4.88	+4.97	+5.06	+5.15	+5.24	+5.33	+5.42	+5.51	+5.60	+5.69	+5.78	+5.87	+5.96	+6.05	+6.14	+6.23	+6.32	+6.41	+6.50	+6.59	+6.68	+6.77
$T_{0,15} = +4.72$	+4.81	+4.90	+4.99	+5.08	+5.17	+5.26	+5.35	+5.44	+5.53	+5.62	+5.71	+5.80	+5.89	+5.98	+6.07	+6.16	+6.25	+6.34	+6.43	+6.52	+6.61	+6.70	+6.79	+6.88
$T_{0,16} = +4.83$	+4.92	+5.01	+5.10	+5.19	+5.28	+5.37	+5.46	+5.55	+5.64	+5.73	+5.82	+5.91	+6.00	+6.09	+6.18	+6.27	+6.36	+6.45	+6.54	+6.63	+6.72	+6.81	+6.90	+6.99
$T_{0,17} = +4.94$	+5.03	+5.12	+5.21	+5.30	+5.39	+5.48	+5.57	+5.66	+5.75	+5.84	+5.93	+6.02	+6.11	+6.20	+6.29	+6.38	+6.47	+6.56	+6.65	+6.74	+6.83	+6.92	+7.01	+7.10
$T_{0,18} = +5.05$	+5.14	+5.23	+5.32	+5.41	+5.50	+5.59	+5.68	+5.77	+5.86	+5.95	+6.04	+6.13	+6.22	+6.31	+6.40	+6.49	+6.58	+6.67	+6.76	+6.85	+6.94	+7.03	+7.12	+7.21
$T_{0,19} = +5.16$	+5.25	+5.34	+5.43	+5.52	+5.61	+5.70	+5.79	+5.88	+5.97	+6.06	+6.15	+6.24	+6.33	+6.42	+6.51	+6.60	+6.69	+6.78	+6.87	+6.96	+7.05	+7.14	+7.23	+7.32
$T_{0,20} = +5.27$	+5.36	+5.45	+5.54	+5.63	+5.72	+5.81	+5.90	+5.99	+6.08	+6.17	+6.26	+6.35	+6.44	+6.53	+6.62	+6.71	+6.80	+6.89	+6.98	+7.07	+7.16	+7.25	+7.34	+7.43
$T_{0,21} = +5.38$	+5.47	+5.56	+5.65	+5.74	+5.83	+5.92	+6.01	+6.10	+6.19	+6.28	+6.37	+6.46	+6.55	+6.64	+6.73	+6.82	+6.91	+7.00	+7.09	+7.18	+7.27	+7.36	+7.45	+7.54
$T_{0,22} = +5.49$	+5.58	+5.67	+5.76	+5.85	+5.94	+6.03	+6.12	+6.21	+6.30	+6.39	+6.48	+6.57	+6.66	+6.75	+6.84	+6.93	+7.02	+7.11	+7.20	+7.29	+7.38	+7.47	+7.56	+7.65
$T_{0,23} = +5.60$	+5.69	+5.78	+5.87	+5.96	+6.05	+6.14	+6.23	+6.32	+6.41	+6.50	+6.59	+6.68	+6.77	+6.86	+6.95	+7.04	+7.13	+7.22	+7.31	+7.40	+7.49	+7.58	+7.67	+7.76
$T_{0,24} = +5.71$	+5.80	+5.89	+5.98	+6.07	+6.16	+6.25	+6.34	+6.43	+6.52	+6.61	+6.70	+6.79	+6.88	+6.97	+7.06	+7.15	+7.24	+7.33	+7.42	+7.51	+7.60	+7.69	+7.78	+7.87
$T_{0,25} = +5.82$	+5.91	+6.00	+6.09	+6.18	+6.27	+6.36	+6.45	+6.54	+6.63	+6.72	+6.81	+6.90	+6.99	+7.08	+7.17	+7.26	+7.35	+7.44	+7.53	+7.62	+7.71	+7.80	+7.89	+7.98
$T_{0,26} = +5.93$	+6.02	+6.11	+6.20	+6.29	+6.38	+6.47	+6.56	+6.65	+6.74	+6.83	+6.92	+7.01	+7.10	+7.19	+7.28	+7.37	+7.46	+7.55	+7.64	+7.73	+7.82	+7.91	+8.00	+8.09
$T_{0,27} = +6.04$	+6.13	+6.22	+6.31	+6.40	+6.49	+6.58	+6.67	+6.76	+6.85	+6.94	+7.03	+7.12	+7.21	+7.30	+7.39	+7.48	+7.57	+7.66	+7.75	+7.84	+7.93	+8.02	+8.11	+8.20
$T_{0,28} = +6.15$	+6.24	+6.33	+6.42	+6.51	+6.60	+6.69	+6.78	+6.87	+6.96	+7.05	+7.14	+7.23	+7.32	+7.41	+7.50	+7.59	+7.68	+7.77	+7.86	+7.95	+8.04	+8.13	+8.22	+8.31
$T_{0,29} = +6.26$	+6.35	+6.44	+6.53	+6.62	+6.71	+6.80	+6.89	+6.98	+7.07	+7.16	+7.25	+7.34	+7.43	+7.52	+7.61	+7.70	+7.79	+7.88	+7.97	+8.06	+8.15	+8.24	+8.33	+8.42
$T_{0,30} = +6.37$	+6.46	+6.55	+6.64	+6.73	+6.82	+6.91	+7.00	+7.09	+7.18	+7.27	+7.36	+7.45	+7.54	+7.63	+7.72	+7.81	+7.90	+7.99	+8.08	+8.17	+8.26	+8.35	+8.44	+8.53
$T_{0,31} = +6.48$	+6.57	+6.66	+6.75	+6.84	+6.93	+7.02	+7.11	+7.20	+7.29	+7.38	+7.47	+7.56	+7.65	+7.74	+7.83	+7.92	+8.01	+8.10	+8.19	+8.28	+8.37	+8.46	+8.55	+8.64
$T_{0,32} = +6.59$	+6.68	+6.77	+6.86	+6.95	+7.04	+7.13	+7.22	+7.31	+7.40	+7.49	+7.58	+7.67	+7.76	+7.85	+7.94	+8.03	+8.12	+8.21	+8.30	+8.39	+8.48	+8.57	+8.66	+8.75
$T_{0,33} = +6.70$	+6.79	+6.88	+6.97	+7.06	+7.15	+7.24	+7.33	+7.42	+7.51	+7.60	+7.69	+7.78	+7.87	+7.96	+8.05	+8.14	+8.23	+8.32	+8.41	+8.50	+8.59	+8.68	+8.77	+8.86
$T_{0,34} = +6.81$	+6.90	+6.99	+7.08	+7.17	+7.26	+7.35	+7.44	+7.53	+7.62	+7.71	+7.80	+7.89	+7.98	+8.07	+8.16	+8.25	+8.34	+8.43	+8.52	+8.61	+8.70	+8.79	+8.88	+8.97
$T_{0,35} = +6.92$	+7.01	+7.10	+7.19	+7.28	+7.37	+7.46	+7.55	+7.64	+7.73	+7.82	+7.91	+8.00	+8.09	+8.18	+8.27	+8.36	+8.45	+8.54	+8.63	+8.72	+8.81	+8.90	+8.99	+9.08
$T_{0,36} = +7.03$	+7.12	+7.21	+7.30	+7.39	+7.48	+7.57	+7.66	+7.75	+7.84	+7.93	+8.02	+8.11	+8.20	+8.29	+8.38	+8.47	+8.56	+8.65	+8.74	+8.83	+8.92	+9.01	+9.10	+9.19
$T_{0,37} = +7.14$	+7.23	+7.32	+7.41	+7.50	+7.59	+7.68	+7.77	+7.86	+7.95	+8.04	+8.13	+8.22	+8.31	+8.40	+8.49	+8.58	+8.67	+8.76	+8.85	+8.94	+9.03	+9.12	+9.21	+9.30
$T_{0,38} = +7.25$	+7.34	+7.43	+7.52	+7.61	+7.70	+7.79	+7.88	+7.97	+8.06	+8.15	+8.24	+8.33	+8.42	+8.51	+8.60	+8.69	+8.78	+8.87	+8.96	+9.05	+9.14	+9.23	+9.32	+9.41
$T_{0,39} = +7.36$	+7.45	+7.54	+7.63	+7.72	+7.81	+7.90	+7.99	+8.08	+8.17	+8.26	+8.35	+8.44	+8.53	+8.62	+8.71	+8.80	+8.89	+8.98	+9.07	+9.16	+9.25	+9.34	+9.43	+9.52
$T_{0,40} = +7.47$	+7.56	+7.65	+7.74	+7.83	+7.92	+8.01	+8.10	+8.19	+8.28	+8.37	+8.46	+8.55	+8.64	+8.73	+8.82	+8.91	+9.00	+9.09	+9.18	+9.27	+9.36	+9.45	+9.54	+9.63
$T_{0,41} = +7.58$	+7.67	+7.76	+7.85	+7.94	+8.03	+8.12	+8.21	+8.30	+8.39	+8.48	+8.57	+8.66	+8.75	+8.84	+8.93	+9.02	+9.11	+9.20	+9.29	+9.38	+9.47	+9.56	+9.65	+9.74
$T_{0,42} = +7.69$	+7.78	+7.87	+7.96	+8.05	+8.14	+8.23	+8.32	+8.41	+8.50	+8.59	+8.68	+8.77	+8.86	+8.95	+9.04	+9.13	+9.22	+9.31	+9.40	+9.49	+9.58	+9.67	+9.76	+9.85
$T_{0,43} = +7.80$	+7.89	+7.98	+8.07	+8.16	+8.25	+8.34	+8.43	+8.52	+8.61	+8.70	+8.79	+8.88	+8.97	+9.06	+9.15	+9.24	+9.33	+9.42	+9.51	+9.60	+9.69	+9.78	+9.87	+9.96
$T_{0,44} = +7.91$	+8.00	+8.09	+8.18	+8.27	+8.36	+8.45	+8.54	+8.63	+8.72	+8.81	+8.90	+8.99	+9.08	+9.17	+9.26	+9.35	+9.44	+9.53	+9.62	+9.71	+9.80	+9.89	+9.98	+10.07
$T_{0,45} = +8.02$	+8.11	+8.20	+8.29	+8.38	+8.47	+8.56	+8.65	+8.74	+8.83	+8.92	+9.01	+9.10	+9.19	+9.28	+9.37	+9.46	+9.55	+9.64	+9.73	+9.82	+9.91	+10.00	+10.09	+10.18
$T_{0,46} = +8.13$	+8.22	+8.31	+8.40	+8.49	+8.58	+8.67	+8.76	+8.85	+8.94	+9.03	+9.12	+9.21	+9.30	+9.39	+9.48	+9.57	+9.66	+9.75	+9.84	+9.93	+10.02	+10.11	+10.20	+10.29
$T_{0,47} = +8.24$	+8.33	+8.42	+8.51	+8.60	+8.69	+8.78	+8.87	+8.96	+9.05	+9.14	+9.23	+9.32	+9.41	+9.50	+9.59	+9.68	+9.77	+9.86	+9.95	+10.04	+10.13	+10.22	+10.31	+10.40
$T_{0,48} = +8.35$	+8.44	+8.53	+8.62	+8.71	+8.80	+8.89	+8.98	+9.07	+9.16	+9.25	+9.34	+9.43	+9.52	+9.61	+9.70	+9.79	+9.88	+9.97	+10.06	+10.15	+10.24	+10.33	+	



The absolute positive and negative maxima of the yearly secular changes  $\Delta P, \Delta F, \Delta X, \Delta Y, \Delta Z, \Delta \delta, \Delta i, \Delta T, \Delta J$  of the nine Earth magnetic elements  $P, F, X, Y, Z, \delta, i, T, J$  are taken from the nine tables (41)-(49) above and are entered into the following tables (54), (55), (56), (57), (58), (59), (60), (61) and (62). All values of Tables (41)-(49) were considered. When setting up Table (59), only the area between the parallels  $\phi = +50^\circ$  and  $\phi = -50^\circ$  were considered.

$\Delta P, \Delta F, \Delta X, \Delta Y, \Delta Z, \Delta T$  and  $\Delta J$  are also given in Tables (54)-(62), as before in (41)-(53) in Gauss units of the 5th decimal.  $\Delta \delta$  and  $\Delta i$  are given in minutes.

Zeit von bis 1600	TABLE (54).			TABLE (55).			TABLE (56).			TABLE (57).			TABLE (58).		
	$\phi$	$\lambda$	$\Delta P$	$\phi$	$\lambda$	$\Delta F$	$\phi$	$\lambda$	$\Delta X$	$\phi$	$\lambda$	$\Delta Y$	$\phi$	$\lambda$	$\Delta Z$
1550							+50°	75°	+386	+10°	30°	+536	-40°	330°	+756
1600							-70°	75°	-362	-30°	300°	-416	+10°	60°	-752
1600	0°	315°	+266	+25°	60°	+118	+60°	60°	+344	-50°	0°	+518	-40°	330°	+752
1650	+20°	60°	-280	-40°	330°	-102	-70°	60°	-312	0°	225°	-444	+30°	60°	-280
1650	-10°	300°	+484	+5°	45°	+198	+40°	45°	+548	+10°	15°	+860	-10°	300°	+1216
1700	+10°	45°	-492	-5°	300°	-154	-80°	105°	-490	+20°	75°	-672	+10°	45°	-1492
1700	-40°	300°	+377	-10°	45°	+115	-90°	315°	+601	-90°	45°	+601	-50°	300°	+1054
1750	0°	45°	-298	-50°	300°	-138	-90°	135°	-601	-80°	240°	-617	-10°	45°	-266
1750	+20°	120°	+204	0°	15°	+215	+30°	15°	+550	-10°	345°	+750	-30°	300°	+747
1800	0°	15°	-559	-30°	300°	-165	-30°	15°	-631	0°	45°	-710	0°	15°	-1582
1800	-50°	285°	+430	+15°	345°	+126	-70°	285°	+572	-50°	330°	+718	-50°	300°	+1518
1850	+10°	345°	-330	-50°	300°	-207	-20°	315°	-715	+20°	30°	-465	+10°	345°	-958
Mittel	$\pm 16^\circ$		$\pm 362$	$\pm 23^\circ$		$\pm 148$	$\pm 58^\circ$		$\pm 517$	$\pm 31^\circ$		$\pm 609$	$\pm 24^\circ$		$\pm 1048$

bis = to; zeit = time; mittel = average

Zeit von bis 1600	TABLE (59).			TABLE (60).			TABLE (61).			TABLE (62).		
	$\phi$	$\lambda$	$\Delta \delta$	$\phi$	$\lambda$	$\Delta i$	$\phi$	$\lambda$	$\Delta T$	$\phi$	$\lambda$	$\Delta J$
1550	+50°	30°	+7.90	0°	330°	+6.84	+50°	60°	+354	-70°	75°	+524
1600	-50°	165°	-6.54	0°	60°	-7.54	-70°	120°	-312	-40°	330°	-578
1600	+50°	15°	+9.26	0°	330°	+6.44	+60°	60°	+404	+60°	120°	+426
1650	+50°	90°	-6.48	0°	60°	-7.66	+50°	300°	-302	-40°	330°	-576
1650	+10°	15°	+10.00	0°	300°	+11.62	+40°	45°	+516	-40°	120°	+662
1700	-50°	150°	-7.88	0°	45°	-15.74	-70°	135°	-460	-30°	300°	-656
1700	+50°	345°	+13.26	-10°	300°	+8.31	-80°	270°	+607	-40°	105°	+516
1750	-50°	270°	-8.15	0°	30°	-8.45	+50°	300°	-383	-60°	315°	-842
1750	-20°	345°	+9.68	-30°	315°	+6.80	+30°	0°	+589	-80°	300°	+647
1800	0°	45°	-7.61	0°	15°	-17.63	-20°	15°	-607	+50°	210°	-490
1800	-40°	345°	+10.81	-40°	300°	+8.21	-70°	270°	+572	-10°	105°	+364
1850	+50°	15°	-6.63	0°	0°	-16.40	-20°	300°	-738	-40°	300°	-1232
Mittel	$\pm 39^\circ$		$\pm 8.68$	$\pm 7^\circ$		$\pm 9.64$	$\pm 51^\circ$		$\pm 486$	$\pm 44^\circ$		$\pm 626$

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Table (50) gives on the average a minimum of  $m$  on the parallel  $\phi = +80^\circ$  for an average over all five or six intermediate times, more or less in the individual series as well. It gives a maximum near  $\phi = +10^\circ$  for  $\Delta F, \Delta X, \Delta Y$  and  $\Delta Z$ ; for  $\Delta X, \Delta Z, \Delta T, \Delta J$ ; on the other hand, there are two minima in the vicinity of the parallels  $\phi = +80^\circ$  and  $\phi = +5^\circ$  and two maxima near  $\phi = +40^\circ$  and  $\phi = -60^\circ$ . Finally,  $m = \Delta \delta$  according to (50) is the smallest on the Equator and increases with latitude toward the poles.

160

The values  $\Delta F, \Delta X, \Delta Z, \Delta i, \Delta T$  and  $\Delta J$  of Table (52) have three minima in the vicinity of  $\lambda = 0^\circ, 165^\circ$  and  $230^\circ$ , and three maxima at  $\lambda = 45^\circ, 240^\circ$  and  $305^\circ$ .  $\Delta T$  and  $\Delta J$  in addition have a 4th minimum near  $\lambda = 75^\circ$  and a 4th maximum at  $\lambda = 120^\circ$ .

$\Delta \delta$  and  $\Delta Y$  in Table (52) have three maxima at  $\lambda = 0^\circ, 165^\circ$  and  $250^\circ$  and three minima at  $\lambda = 120^\circ, 190^\circ$  and  $285^\circ$ .

The averages for the entire Earth according to (50) and (52) are  $m = \Delta F = \pm 0,00041 \text{ g. l.}$ ,  $\Delta P = \pm 0,00115 \text{ g. l.}$ ,  $\Delta T = \pm 0,00153 \text{ g. l.}$ ,  $\Delta X = \pm 0,00160 \text{ g. l.}$ ,  $\Delta Y = \pm 0,00202 \text{ g. l.}$ ,  $\Delta Z = \pm 0,00211 \text{ g. l.}$  and  $\Delta i = \pm 0,00297 \text{ g. l.}$ . Out of the Earth magnetic elements  $F, P, T, X, Y, J$  and  $Z$ ,  $F$  changes the least with time and the vertical component  $Z$  changes the most.

As far as the value  $M$  of Tables (51) and (53) are concerned, numerically they are smaller than the corresponding  $m$  of Tables (50) and (52) because by consideration of the signs + and - part of the number is canceled. On the average for the entire Earth,  $M$  is almost equal to zero, that is,  $\Delta P = +0,00001 \text{ g. l.}$

$$\Delta X = -0,00016 \text{ g. l.}, \Delta Z = -0,00022 \text{ g. l.}, \Delta T = \Delta F = \Delta Y = \Delta Z = 0, \Delta \delta = +0,20, \Delta i = +0,01.$$

For the series of the quantities  $M = \Delta P, \Delta F, \Delta X, \Delta Y, \Delta Z, \Delta \delta, \Delta i, \Delta T$  and  $\Delta J$ , which are shown as averages in the columns of Tables (51) and (53), most of them have two maxima and two minima. Inside of the individual series, the sine usually changes three times and  $M$  goes through zero three times.

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If we finally compare the nine Tables (54)-(62) with Tables (50) or with (52), we obtain the following for the entire Earth

according to Tables (50) or (52) average M	average values of the abso- lute maxima m	according to table
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$\Delta F = \pm 0,00115 \text{ g. l.}$	$\pm 0,00362 \text{ g. l.}$	(54)
$\Delta F = \pm 0,00041 \text{ g. l.}$	$\pm 0,00148 \text{ g. l.}$	(55)
$\Delta X = \pm 0,00160 \text{ g. l.}$	$\pm 0,00517 \text{ g. l.}$	(56)
$\Delta Y = \pm 0,00202 \text{ g. l.}$	$\pm 0,00607 \text{ g. l.}$	(57)
$\Delta Z = \pm 0,00297 \text{ g. l.}$	$\pm 0,01048 \text{ g. l.}$	(58)
$\Delta T = \pm 0,00153 \text{ g. l.}$	$\pm 0,00486 \text{ g. l.}$	(61)
$\Delta J = \pm 0,00211 \text{ g. l.}$	$\pm 0,00626 \text{ g. l.}$	(62)
$\Delta \delta = \pm 2,98$	$\pm 8,68$	(59)
$\Delta i = \pm 2,02$	$\pm 9,64$	(60)

The quantities m are, therefore, three to four times as large as the corresponding values of m; only  $\Delta i$  deviates from this rule slightly because for  $\Delta i$ , this ratio is between four and five.

At the end of this paper one can find a map drawing of the agonic (?) line for epochs 1550, 1650, 1700, 1780 and 1900 which were obtained by transferring the zero lines of declination of Tables (16) and (30) (cf. top of Pages 12 and 19 of this publication) and the zero lines of Table (32) of Publication II page 47-51 on a single sheet having the form of these tables. We have left out all the numerical values of declination here. The ag lines of epoch 1600 have been left off in order not to over burden the small map because they differ only slightly from the values for 1550. Also the ag lines for epochs 1842 and 1885 are not given here because they are not much different from those for epoch 1900.

/61

From this sketch one can see that during the time period of 350 years which we considered, from 1550 to 1900, the displacements of the northwestern half of the European-Asiatic agonic (?) line as well

as the displacement of the southeastern half of the American-Atlantic agonic line were substantial in the direction from east to west and from northeast to southwest. Over the same 350 years, the motions in the southeastern half of the European-Asiatic ag line were much less and they were also much less in the northwestern part of the American-Atlantic line where the direction of motion often change, even though the position changes were primarily from east to west, and later on, from west to east.

Over the last 120 years, from 1780 to 1900, the position changes of the southeastern half of the European-Asiatic ag line and of the northwestern half of the American-Atlantic agonic line were only small. On the other hand, in the northwest half of the European-Asiatic ag line and in the southeast half of the American-Atlantic ag line, the motions were not that small in the direction from east to west. In addition to the primary motions of the agonic lines from east to west, we also find motions in the opposite directions from west to east. According to our map, they change in such a manner that it is difficult to make a forecast for the future or the past (that is, after 1900 or before 1550) for large time intervals. A continuing motion of the ag. line around the Earth is not very likely. Also, the conclusions derived from earlier investigations of pottery found in Etruscan graves (800 BC) that at that time (800 BC) the inclination needle in central Italy pointed not to the North Pole as now, but to the South Pole, is rather unlikely<sup>\*</sup>. As the five tables (33) publication II pages 51-53 and Tables (17) pages 13 and 31 page 20 of the present publication show, the magnetic equator where the inclination is zero has not moved at all over the last 350 years from 1550 to 1900 on the Earth's surface. This is a case even though according to our Table (60) above, at many locations the changes in inclination over time were quite substantial at individual points near the Equator.

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<sup>\*</sup> cf. Meteorological Publication February 1897 page 53.

## TABLE OF CONTENTS

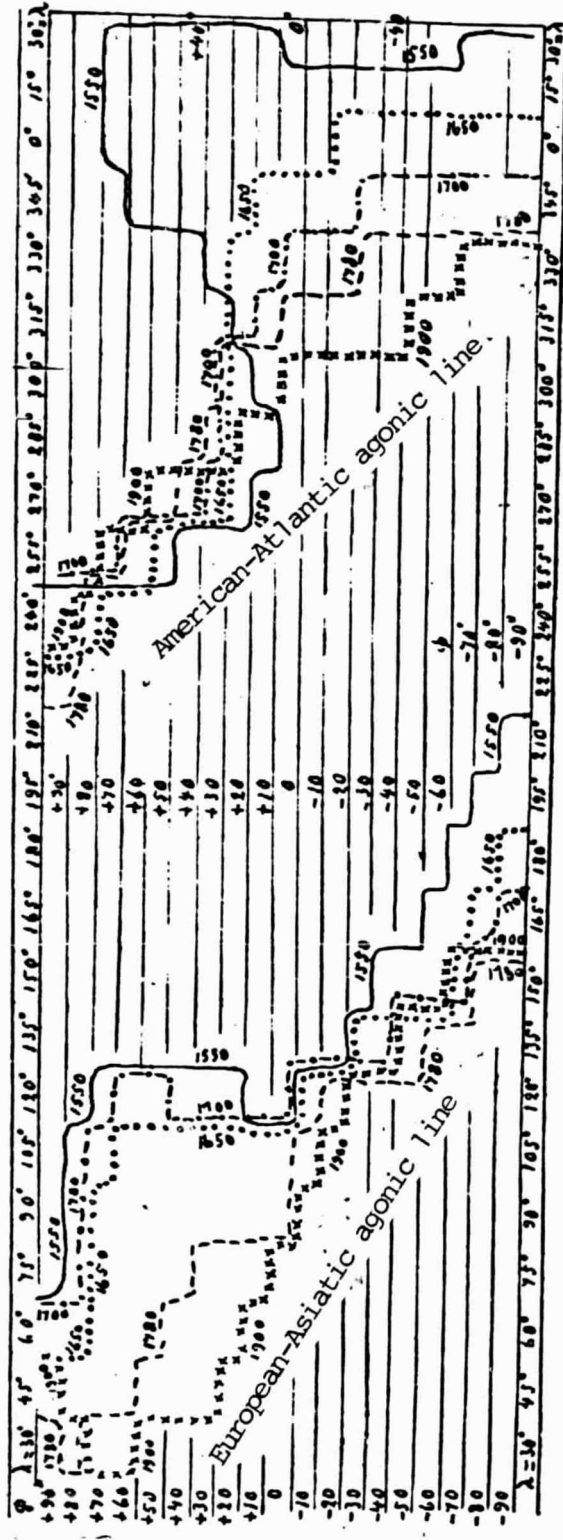
### Chapter I

- a. The influence of magnetically acting agents which are located outside of the Earth's surface. pages 1-8 Tables (1)-(9).
- b. Earth magnetic elements for the epoch 1550 pg. 9-14, Tables (10)-(20).
- c. Earth magnetic elements for the epoch 1900 pg. 15-23, Tables (21)-(36).
- d. Earth magnetic elements for the epoch 1915 pg. 23-25, Tables (37), (38), (39).
- e. Coefficients of the theory for 8 epochs 1550, 1600, 1650, 1700, 1790, 1842, 1885, 1900, pgs 25-26, Table (40).

### Chapter II

- a. Secular changes of the Earth's magnetic elements over the time between 1550-1900. Page 26-61 (Tables (41)-(62)).
- b. Map of the agonic lines from 1550-1900.





The map above shows the two large agonic lines which extend from one pole to the other. Around the time of the seven epochs 1550, 1600, 1650, 1780, 1842, 1885 and 1900, there is a small closed agonic line which separates a region of positive declination from a region of negative declinations which surround it. This small region of positive declinations, according to Tables (14) and (30) and Tables (32) page 28-51 of Publication II had almost the same size and position in the years 1550, 1600 and 1650. It was almost stationary over these 100 years, approximately between the meridian  $\lambda=200^\circ$  and  $\lambda=260^\circ$  as well as between the parallels  $\phi=+30^\circ$  and  $\phi=-30^\circ$  on both sides of the Equator. Around 1700, it vanished and only occurred again during epoch 1780 between meridian  $\lambda=110^\circ$  and  $140^\circ$  and the parallels  $\phi=-60^\circ$  and  $\phi=+25^\circ$  on the northern hemisphere where it has now remained and it has expanded only very slightly through all sides.

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REMARKS

1) Table (6), page 6,  $g_i h_i$  are the coefficients of the Gauss theory for the inner-magnetic Earth's forces.

2)  $\lambda$  is the eastern longitude from Greenwich and  $\phi$  is the geographic latitude.

3) For calculating the elements,  ~~$P, F, X, Y, Z, d, i, j$~~  and  $I$  using the Table (40) above, pages 25-26, and the element  $g_h$  of the theory, one should use the formulas given in Publication I, pages 10-25.